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Monthly Report on the Nuclear Fuel Market

NUEXCO

HEADQUARTERS

Building 3, Suite 290
3000 Sand Hill Road
Menlo Park, California 94025
Telephone: (415) 854-1510
Telecopy: (415) 854-2115
Telex: 470674 (NUEXCO UD)
TWX: 910-373-1760 (NUEXCO MNPK)

J. Robert Wolcott
Chairman

George White, Jr.
President

Wayne D. Fowler
Senior Vice President

Mathias M. Klingler
Chief Financial Officer

Richard K. Andersen, V.P.

Thomas A. Boyden, V.P.

R. Wesley Miller, V.P.

Christian C. Guitton

Kim P. McDonald

Donald W. Radcliffe

Judith L. Sellers

EUROPE

13 chemin du Levant
01210 Ferney-Voltaire
France
Telephone: (33-50) 428035
Telecopy: (33-50) 428526
Telex: 385288 (NUEXCO F)

James E. Vaughan
Senior Vice President

Kathryn K. Bowen

W. Scott Hickman

NORTHEAST UNITED STATES

100 Prospect Street
Century Plaza South
Stamford, Connecticut 06901
Telephone: (203) 323-1999
Telecopy: (203) 325-1483
Telex: 4750124 (NUEXCO C)

Kenneth R. McCue, V.P.

Robert J. Alexander

Earl E. Hoellen, Jr.

Teresa E. Lindsay

SOUTHEAST UNITED STATES

Suite 500
Seven Piedmont Center
Atlanta, Georgia 30305
Telephone: (404) 262-7375
Telecopy: (404) 233-6210
Telex: 4611142 (NUEX ATL)

M. Jerry Reaves, V.P.

James H. Allen

(See inside back cover for list of Representatives and Consultants)

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

February 1984 No. 186

R. WESLEY MILLER, *EDITOR* JAMES J. LIGHTNER, *ASSOCIATE EDITOR*

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To Our Readers

We are pleased to announce that Dr. **Karl Cohen** has joined Nuexco as a special consultant on enrichment technology. A pioneer in the field of nuclear energy, Dr. Cohen has a distinguished record. At the time of his retirement he was Chief Scientist of the Nuclear Energy Group, General Electric Company.

Dr. Cohen began work on uranium isotope separation in 1940, subsequently making major contributions to the theory of isotope separation and the methodology of gaseous diffusion and centrifugal separation. His 1945 book *Isotope Separation* is still the standard reference work in the field.

Dr. Cohen was an early advocate of the now standard light water reactor. At GE he formulated the development program for economic BWRs. He founded and chaired for eight years the company's Reactor Safeguards Council, and established and led the Advanced Reactor Department.

Dr. Cohen currently serves on the National Research Council panel reviewing the Waste Isolation Pilot Plant in New Mexico. He was elected to the National Academy of Engineering in 1967, and is a past President (1968–69) of the American Nuclear Society. He received the 1977 Krupp Foundation prize, and the 1979 Chemical Pioneer Award of the American Institute of Chemists, for his theory of gas centrifuges.

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NATURAL URANIUM AND CONVERSION

The **Exchange Value** as of January 31, 1984 is **$20.50** per pound U_3O_8, down $1.50 since last month. The *Current Market Data* section of this Report lists five uranium sales transactions, involving a total of approximately 9.1 million pounds U_3O_8 *equivalent*. Two of those transactions were long-term sales of U_3O_8, two were long-term sales of natural UF_6, and one involved a spot sale of natural UF_6.

Active supply of uranium (U_3O_8 and UF_6) for spot and near-term delivery totals **4.2 million** pounds U_3O_8 *equivalent*. **Active demand** for spot and near-term delivery totals **510 thousand** pounds U_3O_8 or equivalent UF_6. The spot and near-term **supply-demand ratio** rose dramatically to **8.3:1,** as several buyers previously classified as active withdrew from the market.

The **Transaction Value** as of January 31, 1984 is **$23.05** per pound U_3O_8, down $0.80 since last month. The current Transaction Value includes 17 transactions involving a total of 2.9 million pounds U_3O_8 or equivalent UF_6 and covers a period of 7 months.

The **Loan Use Charge Rate** as of January 31, 1984 is **6 percent** per annum, unchanged since last month. No uranium loans are reported.

* * *

The $1.50 drop in the Exchange Value as of January 31, 1984 came as a number of sellers competed vigorously for a limited number of bids to buy. In particular, offers made to one US utility that purchased a large quantity of natural UF_6 in the spot market severely undercut the previous month's Exchange Value. The contest for that business involved both producers and inventory holders, and signaled the willingness of many sellers to make offers well below those of previous months.

The near quadrupling of the supply-demand ratio for natural uranium also signaled a weakening price structure. Several buyers classified in the previous month's Report as "Active" withdrew from the market, reducing demand by approximately 2 million pounds. The previous level of demand was largely discretionary, and as prices have shown further weakness, some potential buyers with no real near-term needs have withdrawn temporarily in anticipation of a continuing price decline.

* * *

The **Conversion Value** as of January 31, 1984 is **$0.60** per pound U as UF_6, unchanged since last month. No conversion transactions are listed this month. Active secondary market supply of conversion services for delivery within three years totals 3.2 million pounds U as UF_6, while the corresponding demand figure is 330 thousand pounds. The secondary market conversion supply-demand ratio is 9.7 to 1.

Secondary market conversion activity was minimal during January, and, as with natural uranium, demand receded substantially despite the absence of near-term sales transactions. Buyer interest in this market segment appears to have been deterred by the large quantities of natural UF_6 available for sale, which continue to exert downward pressure on the Conversion Value. However, the present Conversion Value appears close to the indifference level of most sellers, who have resisted offering lower prices.

NATURAL URANIUM AND CONVERSION: 1983 REVIEW

Overview

Low, relatively stable prices and greater complexity characterized the market for natural uranium in 1983. Excesses of uranium in the hands of both producers and users prevented a strong price recovery, and at year-end led to renewed price cutting. Natural UF_6 comprised as much as half of the material actively for sale, in large part because of heightened activity in the secondary market for enrichment services. Users that succeeded in disposing of unneeded enrichment commitments were left with natural UF_6 inventories that required liquidation. The Conversion Value fell sharply in the fourth quarter as a result of the natural UF_6 glut.

Exchange Value

The Exchange Value reached $17.00, its lowest point in more than seven years, late in the summer of 1982. Thereafter and through the third quarter of 1983 it recovered modestly but steadily, reaching $24.00. By December 31 it had declined to $22.00, the approximate level of the first quarter of 1983. Table 1 lists the Exchange Value for each month of 1983.

During the third quarter, when the Exchange Value plateaued at the recent high of $24.00, buyers seemed to become more cautious, and market activity was sparse. In the fourth quarter some aggressive sellers attempted to stimulate greater buyer interest, setting in motion the subsequent price decline. Table 2 lists the spot and near-term

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supply and demand for natural uranium and the supply-demand ratio for each month of 1983. Demand remains highly discretionary in the first quarter of 1984.

Conversion Value

Sellers of conversion in the secondary market found little interest in their offers during most of 1983. The Conversion Value peaked in the first quarter of the year at $1.40 per pound U as UF_6 and then declined steadily to $0.60 per pound U, the level that persisted through the fourth quarter. Table 1 lists the Conversion Value for each month of 1983.

By the end of 1983, the Conversion Value applied only to buyers holding U_3O_8 that were explicitly interested in purchasing conversion *services*. This exclusion arose because certain aggressive sellers of natural UF_6 exhibited a willingness to sell at prices equal to competitive offers for U_3O_8, thus nullifying the value of the conversion component of their natural UF_6. In a few instances, buyers succeeded in negotiating prices for UF_6 that were *below* competititve prices for U_3O_8. As a result, sellers of conversion commitments met few buyers, a trend that has continued into 1984. Table 3 summarizes the secondary market supply and demand for conversion services for each month of 1983.

Loan Use Charge Rate

The Loan Use Charge Rate did not change during 1983, staying at 6 percent per annum, because active borrowers were practically nonexistent. A number of potential lenders continued to offer a relatively large and stable supply. Table 3 lists the supply and demand for natural uranium loans. Most potential lenders have been utilities holding large stockpiles of unneeded material, much of it natural UF_6. Potential borrowers seemed to lose interest completely in taking loans when the downturn in spot and near-term market prices commenced in the final quarter of 1983.

Table 1

1983 EXCHANGE VALUES, CONVERSION VALUES AND LOAN USE CHARGE RATES

Determined as of the Last Day of the Month	Report Number	Exchange Value[1] (per lb. U_3O_8)	Conversion Value[2] (per lb. U_3O_8)	Loan Use Charge Rate[3] (per annum)
January	174	$21.50	$1.20	6%
February	175	$21.75	$1.40	6%
March	176	$22.25	$1.40	6%
April	177	$23.25	$1.20	6%
May	178	$23.50	$1.20	6%
June	179	$23.50	$1.20	6%
July	180	$24.00	$1.10	6%
August	181	$24.00	$1.10	6%
September	182	$24.00	$1.00	6%
October	183	$23.50	$0.60	6%
November	184	$22.50	$0.60	6%
December	185	$22.00	$0.60	6%
Annual Average		$23.00	$1.05	6%

[1]Defined on page 10 of this Report. Historical data are reprinted in each Monthly Report.
[2]Defined on page 11 of this Report. Historical data are reprinted in each Monthly Report.
[3]Defined on page 11 of this Report. Historical Loan Use Charge Rates for 1968-1981 appeared in Report 162 on pages 32-34. Rates for 1982 in Report 173 on page 2.

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Table 2

1983 SPOT AND NEAR-TERM[1] SUPPLY AND DEMAND FOR NATURAL URANIUM
(Active Inquiries as Reported by Nuexco)

Determined as of the Last Day of the Month	Report Number	Uranium Supply[2] (Available for Sale)	Uranium Demand[2] (Inquiries to Purchase)	Supply-Demand Ratio	Exchange Value (per lb. U_3O_8)
January	174	9.4	4.7	2.0	$21.50
February	175	8.6	2.8	3.1	$21.75
March	176	7.5	2.9	2.6	$22.25
April	177	8.6	2.6	3.4	$23.25
May	178	5.9	3.1	1.9	$23.50
June	179	6.0	2.3	2.6	$23.50
July	180	7.1	2.6	2.8	$24.00
August	181	6.7	2.4	2.9	$24.00
September	182	7.2	4.4	1.7	$24.00
October	183	5.9	3.1	1.9	$23.50
November	184	5.7	3.1	1.8	$22.50
December	185	5.9	2.5	2.4	$22.00

[1]For delivery within one year.
[2]Millions of pounds U_3O_8 equivalent.

Table 3

1983 SUPPLY AND DEMAND FOR SECONDARY MARKET CONVERSION[1] AND NATURAL URANIUM LOANS[2]
(Active[3] Inquiries as Reported by Nuexco)

Determined as of the Last Day of the Month	Report Number	Conversion Supply (millions of pounds U as UF_6)	Conversion Demand	Loan Supply (millions of pounds U_3O_8 equivalent)	Loan Demand	Exchange Value (per pound U_3O_8)
January	174	3.3	0.2	3.2	1.7	$21.50
February	175	2.6	0.9	3.2	1.0	$21.75
March	176	3.0	0.7	5.1	1.0	$22.25
April	177	4.0	1.1	5.4	1.6	$23.25
May	178	7.0	1.8	4.9	1.1	$23.50
June	179	7.0	1.8	4.9	1.1	$23.50
July	180	7.0	1.8	5.0	1.1	$24.00
August	181	7.0	1.7	5.0	0.3	$24.00
September	182	5.4	1.8	4.0	0.3	$24.00
October	183	5.3	2.1	3.5	0.3	$23.50
November	184	3.5	1.3	3.5	0.3	$22.50
December	185	3.4	1.3	3.5	0.0	$22.00

[1]Data for Reports 174 177 refer to delivery within one year. Data for Reports 178 185 refer to delivery within three years.
[2]Data for all Reports refer to spot and near-term demand, i.e. material to be delivered to the *borrower* within one year.
[3]Involving competitive price, terms and other conditions.

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Analysis of Uranium Sales Transactions

Table 4 shows a breakdown of all 1983 transactions listed in the Report that involved natural uranium for delivery within one year of the date reported. The total quantity involved exceeded 11 million pounds U_3O_8 equivalent.

The number of utility inventory sellers declined sharply from recent years despite year-end indications that it would rise. Producers accounted for a much greater percentage of the sales than utilities, which seems to suggest that the market was edging toward conventional buyer and seller roles during 1983. The majority of uranium sold, however, came from sellers classified as "Other" in Table 4. They include government entities responsible for national uranium inventories, trading companies, and other organizations. Government entities in actuality performed much of the role played by utility inventory sellers during 1982. Trading companies in some cases were able to buy at low prices and sell at higher prices as the Exchange Value rose during the first half of 1983.

Utilities purchased approximately two-thirds of the uranium sold in 1983, while producers purchased only a tenth. These data call attention to the dramatic decline in producer buying from the levels of recent years. Other organizations bought approximately one-fourth of the uranium sold. It appears likely that this pattern of buying will continue in 1984; although some producers and trading companies may increase their purchasing activity. The distribution of *sellers* is liable to change more markedly, as utilities with recognized inventory surpluses attempt liquidation.

Transaction Value

Transactions included in the Transaction Value calculation are a subset of those listed under the category "Uranium Sales" in the *Current Market Data* section of each Report. Historically the Transaction Value, which is a weighted average of prices paid for natural uranium in spot and near-term transactions of immediately preceding months, has trailed the Exchange Value. This was true in 1983 as the Transaction Value recovered slowly from low spot prices of the second half of 1982, gained momentum in the first three quarters of 1983, and then levelled off in the final quarter in response to the drop in the Exchange Value. The Transaction Value and its associated parameters for each month of 1983 are listed in Table 5.

Late in 1983 the Transaction Value hovered above the Exchange Value for three straight months, demonstrating an unusually long delayed response to the concurrent decline in spot prices. Because few buyers actively sought to purchase for the spot and near term late in 1983, price cutting was reflected much more by sellers' offers than by completed sales transactions. No transactions at all were added to the Transaction Value calculation of December 31. Those transactions from the fourth quarter that were included generally involved quantities too small to push the old quantities (exchanged at higher prices) from the calculation, which requires a *minimum* of two million pounds of U_3O_8 or equivalent UF_6.

Thirty-seven 1983 transactions were used in the Transaction Value calculations. The weighted average price in those transactions was $22.55.

Table 4

BUYER AND SELLER GROUPS
IN 1983 URANIUM TRANSACTIONS[1] REPORTED BY NUEXCO
(percentage of total quantity bought and sold each month)

Report	Utility Buyer	Producer Buyer	Other[2] Buyer	Utility Seller	Producer Seller	Other[2] Seller
174	99	1	0	22	43	35
175	52	1	47	28	36	36
176	12	9	79	0	96	4
177	6	33	61	7	32	61
178	36	46	18	30	6	64
179	96	4	0	0	11	89
180	93	7	0	0	24	76
181	97	3	0	0	80	20
182	0	100	0	0	100	0
183	88	6	6	6	0	94
184	100	0	0	0	100	0
Year Total	66%	11%	23%	6%	44%	50%

[1]Natural uranium for delivery within one year of the date reported.
[2]Includes government entities, trading companies, and other organizations.

Table 5

1983 TRANSACTION VALUES[1]
(and Associated Parameters)

Determined as of the Last Day of the Month	Report Number	Transaction Value (per lb. U_3O_8)	Millions of Pounds	Number of Transactions	Number of Months
January	174	$19.35	5.4	12	3
February	175	$20.00	4.2	11	3
March	176	$21.35	2.8	12	3
April	177	$21.40	2.8	13	4
May	178	$22.35	2.1	16	4
June	179	$22.45	2.4	18	5
July	180	$23.50	2.6	19	5
August	181	$23.60	2.0	20	5
September	182	$23.65	2.0	21	6
October	183	$23.65	2.0	21	6
November	184	$23.85	2.3	16	5
December	185	$23.85	2.3	16	6

[1] Defined on page 10 of this Report.

Table 6

1983 URANIUM LOANS AND SECONDARY MARKET CONVERSION TRANSACTIONS REPORTED BY NUEXCO

Loan Transactions

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.U.C.R.	Lender	Borrower
2106	unknown	101-300	108	US Utility	Canadian Producer
2281	1983	601-1,000	108	US Utility	US Producer
2607	1983	50-100	108	US Utility	US Producer
2624	1984	301-600	92	US Utility	US Producer

Secondary Market Conversion Services

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U equivalent)	Approximate Price as Percent of Current C.V.	Seller	Buyer
2097	1984	601-1,000	100 or more	European Utility	European Utility
2245	1983	101-300	less than 100	US Entity	US Utility
2449	1983	50-100	216	European Entity	European Utility
2473	1984	101-300	102	US Utility	US Utility
2505	1984	101-300	183	US Utility	European Utility
2617	1984	50-100	154	US Utility	European Utility

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Loans and Secondary Market Conversion Transactions

Table 6 lists all of the 1983 loans and secondary market conversion transactions that Nuexco reported. A total of four loans and six conversion transactions were reported, reflecting the minimal degree of activity in both markets. There are two particular items of interest regarding the listed transactions.

1. All four borrowers were producers, while the lenders were US utilities. The US utilities, having little or no near-term need for inventory, gained from the resultant interest and from the elimination of storage costs, while producers took advantage of low rates, presumably to meet near-term contract obligations.

2. European utilities comprised four of the six conversion buyers. In general, European utilities have shown more interest in the secondary market for conversion.

Analysis of Pricing Factors

Actual and anticipated inventory liquidations influenced prices in the nuclear fuel market heavily in the fourth quarter of 1983. Cancellations and delays of nuclear power units threatened to, and in many cases did, add uranium to the supply side of the market. Also, worldwide U_3O_8 production continued to exceed consumption by a large margin. Near-term uranium demand was small and largely discretionary throughout the year.

As prices declined during 1981 and 1982, higher cost producers, particularly in the USA, tended to cut back or close down operations and then purchase in the spot market the uranium needed to fulfill existing delivery commitments. However, even the existence of producer demand could not arrest the decline in the Exchange Value before it bottomed in 1982 at $17.00 per pound U_3O_8, the market having been overwhelmed by inventory selling. Most higher cost producers are now out of the market.

Approximately 80 percent of world production today comes from Canada, South Africa, Namibia, Australia, Niger, Gabon and France. Contracts and client relationships in these countries tend to be longer-term and of a different character than those typically found in the USA. These non-US producers are unlikely to suspend operations in favor of open market purchases. Therefore, new producer demand is unlikely to arise in the near future.

The current market situation points to a new structural rigidity. Little flexibility exists in either the production or consumption sectors. Spot prices could vary sharply in the near term as they seek a level that will lead to the movement of material. The situation could be volatile, particularly in the event of unforeseen occurrences affecting nuclear power.

While significant unfilled utility demand exists beginning in the middle to late 1980s, particularly in the USA, utilities have shown no urgency to buy. The existence of large, publicly visible inventories in weak hands has eased any concerns about security of supply both in the near-term and longer-term markets. In the past, US utilities would make new contracts well in advance of their unfilled requirements. However, US utility psychology has changed. Utilities are much more willing to wait until the last minute to purchase uranium. Even if they are wrong about future prices, they can buy at spot prices and avoid criticism. To create new demand, prices must decline to a level at which buyers view current purchases plus carrying costs as more attractive than long-term purchases from primary suppliers.

For the balance of 1984, a spot and near-term price rise is highly unlikely. Recent cancellations of nuclear power units in the USA have had a devastating psychological impact, and they have had an important *actual* impact on spot and near-term market supply. The Marble Hill (Public Service of Indiana) and Zimmer (Cincinnati Gas and Electric) cancellations suddenly made available for sale an additional 5 million pounds U_3O_8 equivalent. While the WPPSS (Washington Public Power Supply System) situation is developing more slowly, it represents another 5 million pounds U_3O_8 equivalent. This material is in various forms, including fabricated fuel, so much of it is less easily sold than is yellowcake. But the lack of operating reactors makes it impossible for its owners to hold the material in inventory for the time being and to consume it at a later date. The market is ripe for aggressive price cutting by the many current holders of inventory.

A final factor liable to have a powerful influence on uranium pricing is the new DOE enrichment contract, the USEC. The contract enables customers gradually to dispose of excess SWUs contracted in the past and to align enrichment services closely with actual reactor needs. Consequently, as utilities convert to the new contract, demand for feed material to fill old contract obligations will diminish. Any reductions in uranium demand will contribute to the general downward pressure on prices.

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SECONDARY MARKET ENRICHMENT SERVICES

The secondary market **SWU Values** as of January 31, 1984 are **$105 for DOE origin** and FY84 delivery, and **$85 for non-DOE origin** and delivery within 15 months. Both SWU Values are unchanged since last month. The *Current Market Data* section of this Report lists three SWU transactions involving a total of approximately 210 thousand SWUs. Active secondary market supply of enrichment services totals approximately 1.2 million SWUs, and active demand amounts to approximately 220 thousand SWUs. The near-term supply-demand ratio is 5.4 to 1; all of the existing demand is for SWUs of DOE origin.

* * *

There was little apparent change in the secondary SWU market during January, as few transactions were completed. The major development, which did not have time to affect buying and selling activity, was the announcement of the terms of the final USEC. It contains a provision, among others, allowing former holders of Requirements contracts to substitute at no charge DOE origin SWUs for up to 30 percent of requirements for FY84-86 deliveries. Over the next few months, both buyers and sellers will be evaluating enrichment strategies for the future in light of the new DOE contract.

TERMS AND CONDITIONS OF THE REVISED USEC

Introduction

DOE issued the final, revised version of the USEC and the associated terms and conditions of conversion on January 18. The final version incorporates a number of important changes from the draft USEC, which was analyzed in last month's Report. Those changes ostensibly were made in response to customers' comments on the draft. However, the time interval for customer comments was noticeably shorter than is customary, so there has been considerable speculation that DOE had already settled on the final version when the draft was issued on December 30. This article describes the most important changes to the contract draft.

Conversion Terms and Conditions

1. The date for a commitment to conversion has been delayed three months, until *October 1, 1984*.

2. All nuclear facilities under contract with DOE must be converted together (as in the draft), but future nuclear facilities would be included *at the customer's request*.

3. Termination notices given after December 31, 1983, but *in furtherance of sales transactions completed before December 31, 1983* may be incorporated.

4. AFC contract holders that convert must still accept 100 percent of their FY84 Appendix A commitments, but may now reduce FY85 commitments by 10 percent and FY86 commitments by 25 percent. Appendix A commitments beginning FY87 are eliminated.

5. Requirements contract holders may convert immediately, and select an immediate 70 percent minimum purchase obligation. The remaining requirements through FY86 must come from DOE origin material. This provision allowing for free substitution of a portion of requirements will help to promote an *active secondary market in DOE origin SWUs*, at least through FY86.

Contract Terms and Conditions

1. Customers may specify a commitment to take from 70 to 100 percent of requirements on a *five-year rolling period*, reduced from ten years.

2. The contract ceiling price is fixed at $135 per SWU through September 30, 1985, but now includes adjustments intended to reflect changes in DOE's costs, including changes in electricity rates, as well as the GNP Implicit Price Deflator.

3. DOE may now charge a price that exceeds the ceiling only with 10 years' notice.

4. Termination charges are reduced to zero with 10 or more years' notice.

In many instances, contract terms and terms of conversion are vague. Ultimately, their definition will be accomplished by the mechanism of policy rulings as discussion continues between DOE and its customers. The contract allows DOE and the customer to "amend this contract . . . to provide terms desirable to the parties, if providing such terms would be in the interest of the Government under the circumstances." Already a number of instances have been reported wherein DOE has indicated to some customers a desire to use that clause to its maximum advantage in encouraging conversion to the USEC.

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USEC AND REQUIREMENTS CONTRACTS: COMPARISON OF PRICE CEILING ESCALATION TERMS

An analysis of the price ceiling terms of the Utility Services enrichment contract (USEC) indicates that the SWU price advantage relative to existing DOE contract prices may be more apparent than real. The USEC ceiling could rise faster than that of the Requirements contract, and, as Adjustable, Fixed-commitment (AFC) contracts customarily are priced below the level of the Requirements contract, the USEC ceiling in the future may also exceed the AFC price.

USEC Pricing

The USEC sets the SWU price ceiling at $135, 100 percent escalated from June 30, 1984. The first annual ceiling adjustment is scheduled to take place in October 1985 according to the following criteria.

1. $67.50 of the price ceiling (50 percent of the base) is adjusted according to the change in the US GNP Implicit Price Deflator (GNPIPD). The GNPIPD is a measure of the US inflation rate.

2. $47.50 of the ceiling (35.2 percent of the base) is adjusted according to the change in the *energy rate* charged to DOE for the electricity supplied to its Gaseous Diffusion Plants. The energy rate addresses the variable cost of power actually used by DOE.

3. $20.00 of the ceiling (14.8 percent of the base) is adjusted according to the change in the electrical power *demand rate* charged to DOE. The demand rate is based on a fixed charge covering the total amount of power DOE is contracted to take, including power not taken.

The escalation formula differs considerably from that of the draft USEC, which based adjustments exclusively on changes in the GNPIPD. The final escalation terms correlate closely with DOE's existing cost structure, and provide DOE with some protection against future increases in the cost of power.

Pricing Terms of Existing Contracts

The current price ceiling for DOE Requirements contracts is $151.93. This ceiling (contained in both 3.5-year and 5-year Requirements contracts), has a base of $30, 33 percent of which is not escalated at all, and 67 percent of which is escalated according to the following formula.

1. $15 (50 percent of the base) is adjusted according to changes in the average *total power cost* that DOE pays to its electricity suppliers.

2. $5 (16.7 percent of the base) is adjusted according to changes in the costs for labor in Chemical and Allied Products Industries (US Bureau of Labor Statistics, SIC 28).

The AFC contract, first issued in 1978, does not contain a conventional price ceiling. However, it does contain a provision permitting customers to terminate the contract at no cost if the SWU price exceeds 130 percent of that price which represents full cost recovery for the US government. DOE considers AFC contracts less risky because they, unlike Requirements contracts, do not require DOE to deliver SWUs according to a schedule that can change with as little as 180 days notice. Consequently, DOE historically has established the AFC price well below the Requirements SWU price. Nevertheless, DOE determines exactly what price represents full cost recovery. Therefore, the prices of SWUs under AFC contracts may be subject to arbitrary manipulation by DOE.

Trends in Escalation Terms

Figure 1 compares three curves:

1. the actual Requirements contract price ceiling from 1966 1983;

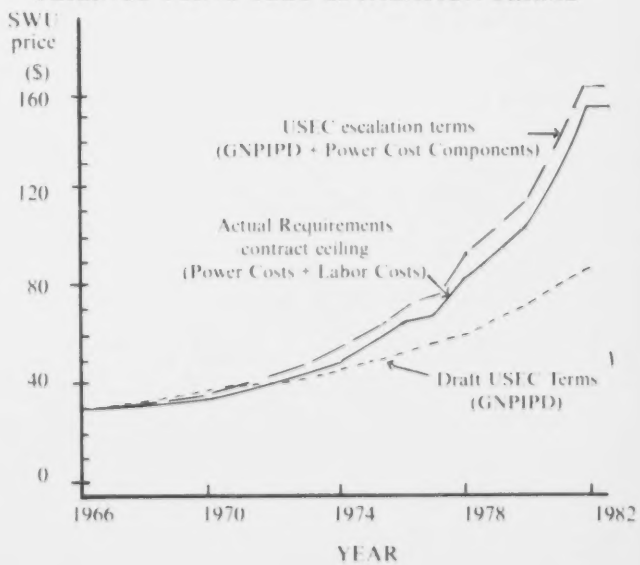
2. the hypothetical ceiling had the escalation terms of the final USEC applied;

3. the hypothetical ceiling had the escalation terms of the draft USEC applied.

Since 1965, the base year of the Requirements contract, the average total power cost that DOE pays has risen an astounding 720 percent. Labor costs have risen 270 percent. The sharp rise in total power costs came during the 1970s, when energy price inflation was rampant.

Figure 1

COMPARISON OF REQUIREMENTS CONTRACT PRICE CEILING WITH HYPOTHETICAL CEILINGS USING USEC ESCALATION TERMS



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Fifty percent of the USEC base is adjusted to power costs in their component forms, so had the escalation terms of the USEC applied to the Requirements contract, the ceiling would have risen equally dramatically. The other 50 percent of the USEC base is adjusted to the GNPIPD; that index has risen steadily over the past twenty years (180 percent from 1965).

Future Ceiling Levels

Although it is difficult to project future trends in the relevant escalation indices, certain observations support the conclusion that the USEC price ceiling may rise faster than the existing Requirements contract ceiling.

1. Escalation provisions apply to only 67 percent of the Requirements base. 100 percent of the USEC base is escalated.

2. Generally the GNPIPD rises steadily, while power costs are influenced by independent variables, namely energy charges and demand charges.

3. In an effort to reduce costs to the US government, DOE has been attempting to reduce demand charges, and particularly charges for power not taken levied by the Tennessee Valley Authority (TVA). If DOE's demand charges are diminished, average total power costs, according to which 50 percent of the Requirements base is adjusted, will fall substantially. Only 14.8 percent of the USEC base is adjusted to demand charges, so reducing them would have a lesser impact on USEC escalation.

Nuexco estimates that the 1984 power cost used in the Requirements contract ceiling escalation will be approximately 35.7 mills per kilowatt hour (m/kwh). That estimate *includes* the component of the charge for power not taken. Eliminating that component would reduce DOE's expected total power cost to 28 m/kwh. Assuming an 8 percent annual escalation for the labor cost index, the 1984 Requirements contract price ceiling will be approximately $165 if the power not taken charge is included in the demand rate, and $135 if it is eliminated.

USEC TERMINATION CHARGES

The charge for termination under the draft version of the USEC was defined as the price of one SWU (S) minus the price component representing the energy portion of the electric power charge (E) times the number of cancelled SWUs (C) times a multiplier (M) that is based on the notice period given by the customer.

$$\text{Termination Charge} = (S - E)(C)(M).$$

The final version of the USEC contained an added proviso, that M = 0 if notice is given ten years or more in advance of scheduled deliveries.

The General Accounting Office (GAO) analysis of DOE's power costs for the next 10 years estimates that the energy portion of the electric power charge to DOE will average 65 percent of total power costs. (The remaining 35 percent will be comprised of demand charges.) DOE's FY84 breakdown of the AFC contract price shows total power costs of $67 per SWU, representing 48 percent of the contract price ($138.65). Using the GAO figure of 65 percent, the energy component of the AFC SWU price is equal to 0.65 × 48 = **31 percent.** If the energy component were to remain constant at 31 percent, the absolute value of the USEC termination charge would be as shown in Table 7.

Table 7

COMPARISON OF TERMINATION CHARGES

Notice Period (years)		Percentage of SWU Price		
More Than	Not More Than	USEC[1]	Requirements 5-year	Requirements 3.5-year
0	1	69	40	25
1	2	62	40	20
2	3	55	40	15
3	4	48	40	10
4	5	41	40	0
5	6	34	0	0
6	7	28	0	0
7	8	21	0	0
8	9	14	0	0
9	10	7	0	0
10+		0	0	0

[1] Assumes energy component of power costs equal to 31 percent of SWU price.

The termination charge as a percentage of the USEC SWU price would increase if DOE were to begin operation of the Gaseous Centrifuge Enrichment Plant (GCEP) or Advanced Laser Isotope Separation Process (AVLIS). For those technologies the energy component would be a smaller fraction of the total SWU cost, so the credit associated with the energy component would be reduced.

The only significant change in the termination terms from the draft to the final version of the USEC is the ability to terminate at no cost with 10 or more years notice. Although the USEC allows partial termination, former Requirements customers will be able to obtain required enrichment services from non-DOE suppliers only by paying termination charges that are much higher than those specified in their present contracts (Table 7). Except for the contract provision allowing free substitution of a limited number of DOE SWUs from another DOE customer, the USEC makes termination for secondary market participation an unattractive option.

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CURRENT MARKET DATA

EXCHANGE VALUE $20.50/lb. U_3O_8
Determined as of January 31, 1984

Definition

The Exchange Value is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.

Derivation

Nuexco bases the Exchange Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Exchange Value:

A. The price of uranium delivered or to be delivered under old contracts.
B. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.

TRANSACTION VALUE[1]
Determined as of January 31, 1984

$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
23.05	2.9	17	7

Definition

The Transaction Value is a weighted average price of recent transactions, and is based on prices paid for U_3O_8 in:

A. Transactions closed within the previous three-month period for which delivery was scheduled within one year of the transaction date;
B. At least ten transactions;
C. Transactions involving a sum total of at least two million pounds U_3O_8 equivalent.

The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars as of the transaction date.

Comments

Nuexco does not consider the following in determining the Transaction Value:

A. The price of uranium delivered in connection with contract renegotiations or other than arm's length transactions.
B. The price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of Exchange Value or any other independent variable.
C. Transactions in which the delivery price is defined in such a way that it cannot currently be determined.

[1]Transaction Values for 1976 through 1981 and their associated parameters (millions of pounds, number of transactions and number of months) are tabulated on pages 31 and 32 of Report 161. The corresponding data for 1982 are tabulated on page 5 of Report 173, and for 1983 on page 5 of Report 186.

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CURRENT MARKET DATA

LOAN USE CHARGE RATE[1] 6%
Determined as of January 31, 1984

Definition

The Loan Use Charge Rate is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.

Derivation

Nuexco bases the Loan Use Charge Rate upon:

A. Data from recently completed or pending loan transactions.
B. Rates included in firm proposals to borrow or lend.
C. Rates that potential borrows and lenders have expressed as a willingness to pay or accept, but for which Nuexco is not aware of firm proposals.

[1]Monthly data for 1968 through 1981 appear on pages 32-34 of Report 162. Monthly data for 1982 appear on page 2 of Report 173.

CONVERSION VALUE $0.60/lb. U as UF_6
Determined as of January 31, 1984

Definition

The Conversion Value is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.

Derivation

Nuexco bases the Conversion Value upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.

Comments

Nuexco does not consider the following in determining the Conversion Value:

A. The price of conversion services delivered or to be delivered under old contracts.
B. The price of conversion services delivered in connection with contract renegotiations or other than arm's length transactions.
C. Transportation charges other than those customarily provided by primary suppliers of conversion services.

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CURRENT MARKET DATA

SWU VALUES

$105/SWU FOR DOE ORIGIN AND FY84 DELIVERY
$85/SWU FOR NON-DOE ORIGIN AND DELIVERY WITHIN 15 MONTHS
Determined as of January 31, 1984

Definition

The SWU (Separative Work Unit) Values represent Nuexco's judgment of the price, expressed in US dollars per SWU, at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.

Derivation

Nuexco bases the SWU Values upon:

A. Data from recently completed transactions.
B. Data from pending transactions.
C. Firm bids to buy and firm offers to sell.
D. Prices purchasers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy, and prices sellers have expressed a willingness to accept, but for which Nuexco is not aware of firm offers to sell.
E. SWU prices at varying tails assays and varying product assays are converted to the equivalent SWU price at the DOE Reference Transaction Tails Assay (presently 0.20 weight percent U^{235}) and a product assay of 3.0 weight percent U^{235} assuming feed costs calculated using the Nuexco Exchange Value and Nuexco Conversion Value determined as of the last day of the same month.

Comments

Nuexco does not consider the following in determining the SWU Values:

A. The price of SWUs delivered under long-term contracts from primary suppliers, such as DOE, Urenco, or Eurodif.
B. The price of SWUs delivered under other than arm's length transactions.

EXCHANGE RATES[1]
(Currency per US Dollars)

Country (currency)	This Month (Jan 31, 1984)	Last Month (Dec 29, 1983)	12 Months Ago (Jan 28, 1983)	Percent Change Over 12 Months
Australia (dollar)	1.09	1.11	1.03	5.8
Belgium (comm. franc)	57.44	55.70	47.72	20.4
Canada (dollar)	1.25	1.24	1.24	0.8
Finland (markka)	5.94	5.83	5.40	10.0
France (franc)	8.60	8.34	6.87	25.2
FRG (mark)	2.81	2.73	2.43	15.6
Italy (lira)	1713.00	1661.00	1403.00	22.1
Japan (yen)	234.57	232.05	236.20	0.7
Netherlands (guilder)	3.16	3.07	2.67	18.4
South Africa (rand)	1.27	1.22	1.07	18.7
Spain (peseta)	158.55	157.55	128.90	23.0
Sweden (krona)	8.18	8.01	7.43	10.1
Switzerland (franc)	2.24	2.18	1.99	12.6
UK (pound)	0.71	0.69	0.65	9.2
US (dollar)	1.00	1.00	1.00	0.0

[1]Currency exchange rates from the *Wall Street Journal* of the date indicated.

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EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates	per lb. U_3O_8 12 Months Ago
Australia (dollar)	22.33	49.24	58.06	22.07
Belgium (comm. franc)	1,177	2,596	3,061	1,029
Canada (dollar)	25.60	56.43	66.54	26.56
Finland (markka)	121.81	268.54	316.67	116.03
France (franc)	176.42	388.94	458.65	148.07
FRG (mark)	57.65	127.09	149.87	52.26
Italy (lira)	35,121	77,428	91,306	30,197
Japan (yen)	4,809	10,602	12,502	5,078
Netherlands (guilder)	64.83	142.93	168.55	57.41
South Africa (rand)	25.98	57.28	67.55	22.92
Spain (peseta)	3,250	7,166	8,450	2,771
Sweden (krona)	167.76	369.84	436.13	159.73
Switzerland (franc)	45.97	101.36	119.52	42.76
UK (pound)	14.56	32.11	37.87	13.98
US (dollar)	20.50	45.19	53.30	21.50

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates	per kg U_3O_8 in Concentrates	per kg U in Concentrates	per lb. U_3O_8 12 Months Ago
Australia (dollar)	25.11	55.36	65.28	19.86
Belgium (comm. franc)	1,324	2,919	3,442	926.10
Canada (dollar)	28.78	63.45	74.82	23.90
Finland (markka)	136.96	301.94	356.06	104.43
France (franc)	198.36	437.32	515.70	133.26
FRG (mark)	64.82	142.90	168.52	47.03
Italy (lira)	39,489	87,059	102,664	27,177
Japan (yen)	5,407	11,920	14,057	4,570
Netherlands (guilder)	72.90	160.71	189.52	51.67
South Africa (rand)	29.21	64.41	75.95	20.63
Spain (peseta)	3,655	8,057	9,501	2,494
Sweden (krona)	188.63	415.85	490.38	143.76
Switzerland (franc)	51.69	113.96	134.39	38.48
UK (pound)	16.38	36.10	42.58	12.58
US (dollar)	23.05	50.82	59.92	19.35

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on January 31, 1984.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as U_3O_8	per kg U as U_3O_8	per lb. U 12 Months Ago
Australia (dollar)	0.65	1.44	1.23
Belgium (comm. franc)	34.46	75.98	57.42
Canada (dollar)	0.75	1.65	1.48
Finland (markka)	3.57	7.86	6.48
France (franc)	5.16	11.38	8.26
FRG (mark)	1.69	3.72	2.92
Italy (lira)	1,028	2,266	1,685
Japan (yen)	140.75	310.29	283.42
Netherlands (guilder)	1.90	4.18	3.20
South Africa (rand)	0.76	1.68	1.28
Spain (peseta)	95.13	209.73	154.68
Sweden (krona)	4.91	10.82	8.92
Switzerland (franc)	1.35	2.97	2.39
UK (pound)	0.43	0.94	0.78
US (dollar)	0.60	1.32	1.20

SWU VALUES EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU FY84	Non-DOE SWU delivery w/in 15 mo.
Australia (dollar)	114.39	92.60
Belgium (comm. franc)	6,031	4,882
Canada (dollar)	131.10	106.13
Finland (markka)	623.89	505.05
France (franc)	903.61	731.50
FRG (mark)	295.28	239.03
Italy (lira)	79,887	145,623
Japan (yen)	24,631	19,939
Netherlands (guilder)	332.07	268.82
South Africa (rand)	133.08	107.73
Spain (peseta)	16,648	13,477
Sweden (krona)	859.25	695.58
Switzerland (franc)	235.48	190.63
UK (pound)	74.60	60.39
US (dollar)	105.00	85.00

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on January 31, 1984.

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RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current E.V.	Seller	Buyer	Remarks
2661	1984-93	1,501-3,000	indeterminate	Canadian Producer	European Utility	UF_6.
2652	1984	601-1,000	97	Canadian Producer	US Utility	UF_6. Assumes conversion cost of $0.60 per lb. U.
2645	1985-92	1,001-1,500	indeterminate	US Producer	US Utility	Price related to market.
2644	1985-89	601-1,000	indeterminate	US Producer	US Utility	Price related to market.
2598	1988-97	3,000-5,000	indeterminate	Canadian Producer	European Utility	UF_6. Price related to market.

Secondary Market Enrichment Services

Nuexco Transaction Number	Delivery Period[2]	Approximate Quantity (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Tails Assay (Percent U^{235})	Seller Group	Buyer Group	SWU Origin	Remarks
2660	1984	0-50	unknown	0.2	US Utility	European Utility	DOE	
2634	1989	50-100	indeterminate	to be determined	European Entity	European Utility	Eurodif	
2608	1985	101-300	100-104	0.3	Mexican Utility	US Utility.	DOE	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]Refers to calendar year, not fiscal year.
[3]Price is not normalized to 0.20% tails assay.
[4]Refers to SWU Value for same origin as SWUs included in transaction.

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CURRENT MARKET DATA

URANIUM SUPPLY
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1575	—	500 per year	1985 on
1818	—	500 per year	1984-90
2038	1,000	—	UF_6
2134	—	250 per year	1984-87
2201	300	—	
2203	—	1,000 per year	1984-93
2220	150	—	UF_6
2236	—	200 per year	1985-89
2263	—	500 per year	1985-90
2274	—	600 per year	1985-91
2275 A	110	—	
2297	—	200 per year	1985-89
2307	340	—	UF_6
2315	170	950	UF_6
2335	200	—	
2336	—	250 per year	1985 on
2350	30	—	
2365	20	—	
2366	600	—	1984-85
2376	50	—	UF_6
2389	300	—	
2390	500	—	
2429	450	—	
TOTAL:	4,220		
INACTIVE			
0564	—	1,000 per year	1986-90
2017	1,100	1,200	
2191	125	—	UF_6
2193	—	800 per year	1986-90
2271	—	500 per year	1984-85
TOTAL:	1,225		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

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URANIUM DEMAND
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2217	—	8,700	1988 on
2302	—	330 per year	1988 on
2313	220	—	
2329	—	500	1985
2352	240	—	
2413	—	250 per year	1987-88
2419	50	—	UF_6
TOTAL:	510		
INACTIVE			
1999	—	50 per year	1985-90
2118 A	250	—	
2244	—	350 per year	1985 on
2310 A	800	—	enriched UF_6
2372	—	250 per year	1985-88
2411	300	—	
2414	—	100 per year	1987-91 U_3O_8 or UF_6
TOTAL:	1,350		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.

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CURRENT MARKET DATA

LOAN SUPPLY AND DEMAND
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan:			
ACTIVE			
1938	1,500	—	UF_6
2128	1,000	—	
2483	545	—	
TOTAL:	3,045		
INACTIVE			
2036	500	—	UF_6
2139	2,000	—	
TOTAL:	2,500		
Inquiries to Borrow:			
INACTIVE			
2118	250	—	U_3O_8 or UF_6
TOTAL:	250		

[1]Measured from the date of this Report.

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CONVERSION SUPPLY AND DEMAND
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as U$_3$O$_8$) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2051	1,500		
2141	1,500		
2220 A	210		
TOTAL:	3,210		
INACTIVE			
1936	1,500		
2230	300		
2401	600		
TOTAL:	2,400		
Inquiries to Purchase:			
ACTIVE			
2386	330		
TOTAL:	330		
INACTIVE			
2287		250 per year	1987 on
2295	200		
2372 A		250 per year	1985 on
2420	310		
TOTAL:	510		

[1]Measured from the date of this Report.

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CURRENT MARKET DATA

SWU SUPPLY
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1895	—	500	
2040	55	—	
2052	270	—	
2100	—	100 per year	1984-89
2164	80	—	
2189	85	80	1985
2192	—	325	
2210	—	70	1985
2285	500	3,000	
2345	—	500	1985
2351	—	150 per year	1985-91
2359	180	—	
2378	—	120 per year	1985-88
2408	—	120	1985
2428	—	200	1985
TOTAL:	1,170		
INACTIVE			
2337	250	250	
2375	200	—	
TOTAL:	450		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

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SWU DEMAND
(As of 1/31/84)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2142	--	35	1985
2233	85	--	
2346	--	100 per year	1985-90
2355	--	180 per year	1986,88,90,92
2374 B	--	90	1985
2382	--	110	1985-86
2391	60	40	1985
2400	--	85	1985
2412	--	80	1985
2448	70	--	
TOTAL:	215		
INACTIVE			
2237	--	250 per year	1985 on
2310	200	--	
2450	--	100	1987
TOTAL:	200		

[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.

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RECENT DEVELOPMENTS

FEDERAL REPUBLIC OF GERMANY

The FRG's nuclear power program suffered an aggravating setback in January when a court order forced a stop to construction on Isar Unit 2, owned by Bayernwerk (40 percent), Isar-Amperwerke (25 percent), Stadtwerke Muenchen (25 percent), and Energy Versogung Schwaben (EVS) (10 percent). A local landowner filed suit against the owners on the basis that the plant was unsafe, and in considering the case the court discovered what it considered to be a design problem.

The original design of the so-called "convoy" units (Table 8), of which Isar Unit 2 is one, provided for braces to be constructed around certain steam pipes to prevent them from swinging in the event of pipe breakage. Subsequently it was determined that braces are unnecessary because the probability of pipe breakage is small and the potential damage from swinging pipes limited. The requirement for these braces was therefore stricken from the convoy plant design.

The German court ruled that construction must be halted until the change to the plant design has been subjected to the required public hearing. Thus, on January 16, work on Isar Unit 2 ceased and some 1,000 workers were laid off. The utilities are upset about the loss of time and money that will ensue, and a segment of the local population is angered by the loss of work. On the other hand, anti-nuclear advocates are rallying to this opportunity to hamper the nuclear industry.

The four utilities involved immediately appealed the decision on the basis that the design change was very minor and did not necessitate a full public hearing. The results of this appeal are still pending. In any event, it is estimated that this incident will cause a minimum delay of six months, and should a full public hearing be required, the delay could extend to three or four years.

One obvious solution would be to install the braces as previously proposed. However, such an action if taken would constitute an open invitation to anyone to challenge minor changes in nuclear units. In addition, the installation of the braces might force the same action on the other owners of convoy units.

Meanwhile, owners of other convoy units are considering their own situations, and are trying to decide if they should install the braces, hold open public hearings on the design changes, or simply continue construction. And of course they are anxiously awaiting the results of the appeal of the ruling on Isar Unit 2.

NETHERLANDS

A nationwide attempt to reach a collective decision regarding the future of nuclear power in the Netherlands has come to a disappointing and somewhat inconclusive end. All over Holland the government distributed questionnaires so that private citizens could express their opinions on nuclear power. When the counting was finished, there were only some 25,600 respondents from this country of 14.3 million. Of those, 14 percent favored nuclear energy, 31 percent questioned the value of nuclear power, and 50 percent openly opposed nuclear power.

There seemed to be a consensus among respondents that the two existing units in the Netherlands, Dood-

Table 8

CONVOY UNITS IN THE FEDERAL REPUBLIC OF GERMANY

Unit	Primary Utility	Type	Output (MWe net)	Percent Complete	COD[1]
Under Construction					
Isar 2	Bayernwerk	PWR	1285	25	1988
Emsland	VEW	PWR	1222	10	1989
GKN-2	GKN	PWR	1230	15	1990
Planned					
Wyhl	Badenwerk EVS	PWR	1284	0	indefinite
Biblis C	RWE	PWR	1237	0	indefinite
Total MWe			6,258		

[1]Commercial Operating Date. Based on published sources and utility forecasts.

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waard and Borsele, should continue operating because the cost to close them (estimated at anywhere between $300 million and $1.3 billion) would be prohibitively high, and some value was perceived in continuing the research aspect of the reactors. However, the responding group also felt that no new reactors should be built until an adequate waste disposal plan has been developed.

While not binding on the government or utilities, the survey was intended to clarify the national position on this issue. In fact, the limited response to the survey may be most indicative of apathy. Future nuclear plant construction is likely to be based on capital costs and load growth rates rather than on the results of opinion polls.

CORRECTIONS TO PREVIOUS REPORTS

Free World Convertors

On page 28 of last month's Report (Number 185), in the article entitled *Nuclear Power in the United Kingdom*, the first sentence under the heading "Fuel Cycle Services" incorrectly reads: "BNFL, which operates the largest conversion facility in the Free World, provides for most of the upgrading, manufacture and reprocessing of fuel needed by the domestic nuclear program."

The sentence should state that BNFL operates the *fourth* largest conversion facility in the Free World. Based on name plate rating, Eldorado in Canada has the largest conversion operation at 14,500 MTU annually (9,000 MTU of which is new capacity). Eldorado is followed by Allied in the USA (12,700 MTU), Comurhex in France (12,000 MTU), BNFL in the United Kingdom (9,500 MTU), and Sequoyah Fuels Corp. (formerly Kerr-McGee) in the USA (9,100 MTU).

Japanese Electricity Generating Plants

On page 30 of the last Report (Number 185), in the article entitled *Japan's Nuclear Power Infrastructure*, Table 6 lists the total number of operating electricity generating plants in Japan as 3,429. The total should read 2,429.

Canadian Government Statistics

Since March of 1983 (Report 175) the table of Canadian Government Statistics has listed an average hourly earnings wage earner series under the incorrect title "Metal Mining, Including Milling (SIC 050-099)." The *correct* title, as shown in this Report, is "Mines, Quarries and Oil Wells (SIC 051-099)." The numbers published were correct for that earnings series.

The *Government Statistics* section of this Report lists average hourly earnings data for three separate wage earner series in Mining:

1. Mines, Quarries and Oil Wells (SIC 051-099);
2. Metal Mines (SIC 051-059);
3. Uranium Mines (SIC 057).

These three series will be continued in future Reports.

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ANNUAL REVIEW

CANADA

With the addition in 1983 of the new Key Lake mine and the recommissioned Stanleigh mine, Canada's U_3O_8 production rate has surpassed that of the USA as the foremost in the world. Nuexco's recent survey of Canadian production operations indicates that Canada's 1983 U_3O_8 output totaled approximately 19 million pounds, over 60 percent of which came from the province of Ontario, with the balance from Saskatchewan. Saskatchewan is expected to produce at a higher annual rate early in 1984.

Key Lake Startup

The opening of the Key Lake operation highlighted uranium developments during 1983. Plant construction took just over two years and cost approximately 90 percent of the projected $500 million. Milling of ore began on October 3, 1983, and the first drum of yellowcake was packaged on October 20. By year-end the mine had produced almost 1.6 million pounds. Key Lake is now the largest operating uranium mine in the world. Reserves total some 200 million pounds U_3O_8 at an average grade of 2.35 percent. The operation's design capacity of 1 million pounds U_3O_8 per month should be reached by the third quarter of 1984.

Key Lake is owned jointly by Saskatchewan Mining Development Corporation (SMDC) (50 percent), Uranerz Exploration and Mining, Ltd. (33.33 percent) and Eldor Resources, Ltd. (16.67 percent). SMDC already has contracts committing 80 percent of its share of production through 1990. SMDC, which also owns a 20 percent share of Cluff Lake in Saskatchewan (Amok, Ltd. owns the other 80 percent) and a 50.75 percent of the promising Waterbury deposit, has joined the ranks of the largest uranium producers with 6.5 million pounds annual share of production.

Cigar Lake Discovery

Following detailed work in the Cigar Lake area, SERU Nucleaire, the operator of the Waterbury Joint Venture, defined a rich uranium-bearing orebody in 1983. By year-end sixty-five holes had been drilled over a 600 meter length, with some holes having average grades up to 25 percent. Reserve estimates exceed 125 million pounds U_3O_8 at an average grade of 5–10 percent. Waterbury is a deeper deposit than Key Lake; in the holes drilled, mineralization occurred at depths of 410–440 meters. Drilling will continue in 1984 in an effort to extend the proven reserves. In addition to SMDC's 50.75 percent share, SERU Nucleaire owns 33.625 percent of the venture, Idemitsu Uranium Exploration Canada has an 11.875 percent share, and Reserve Oil and Minerals owns 3.75 percent.

Stanleigh Mine Recommissioned

During 1983 Rio Algom Ltd. recommissioned the Stanleigh mine at Elliot Lake in Ontario. Stanleigh originally provided U_3O_8 to the US government in the latter 1950s and was shut down in 1960. Reactivation of the mine cost $386 million. By year-end the mine had produced approximately 500,000 pounds. The entire output will go to Ontario Hydro, in accordance with a Rio Algom contract to deliver 72 million pounds U_3O_8 between 1983 and 2020. Deliveries were set in 1982 at 770 MTU (approximately 2 million pounds) per year through 2003, with slightly lower deliveries beyond that time.

Export Policy Upheld

After announcing some modifications to its export policy in the third quarter of 1983 the Canadian government reaffirmed the basic provisions with respect to pricing and upgrading. Export contracts must contain a floor price or similar mechanism that protects "investment and employment in uranium production facilities." In the past the pricing policy was more specific in requiring floor prices or annual price negotiations.

The requirement that uranium be exported in its most advanced form (natural UF_6 in Canada) remains in effect. In the past the government has shown a willingness to accommodate particular buyer problems by, for example, approving U_3O_8 export contracts for buyers having conversion commitments outside of Canada. However, the government may be less willing to approve U_3O_8 export contracts in the future. Eldorado Nuclear Ltd., the Canadian government convertor, completed a new facility at Port Hope in 1983, making additional business highly desirable.

Nuclear Power Developments

There are currently twelve Candu reactors operating commercially in Canada, and twelve are under construction or planned (Table 9). Three new units became operational in 1983, New Brunswick EPC's Point Lepreau Unit 1, Ontario Hydro's Pickering Unit 5 and Hydro Quebec's Gentilly 2. In the second half of the year Ontario Hydro experienced a number of problems with pressure tube

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Table 9

COMMERCIAL NUCLEAR REACTORS IN CANADA

Unit	Utility	MWe (net)	Percent Complete	Commercial Operation
Douglas Point	Ontario Hydro	206	100	Sep 1968
Pickering 1	Ontario Hydro	515	100	Jul 1971
Pickering 2	Ontario Hydro	515	100	Dec 1971
Pickering 3	Ontario Hydro	515	100	Jun 1972
Pickering 4	Ontario Hydro	515	100	Jun 1973
Bruce 1	Ontario Hydro	740	100	Sep 1977
Bruce 2	Ontario Hydro	740	100	Sep 1977
Bruce 3	Ontario Hydro	740	100	Feb 1978
Bruce 4	Ontario Hydro	740	100	Jan 1979
Point Lepreau 1	New Brunswick EPC	630	100	Jan 1983
Pickering 5	Ontario Hydro	515	100	May 1983
Gentilly 2	Hydro Quebec	640	100	Dec 1983
Total Operational		7,011		
Under Construction or Planned				
Pickering 6	Ontario Hydro	515	90	Apr 1984
Bruce 6	Ontario Hydro	750	85	Jun 1984
Bruce 5	Ontario Hydro	750	75	Nov 1984
Pickering 7	Ontario Hydro	515	85	Dec 1984
Pickering 8	Ontario Hydro	515	75	Jul 1985
Bruce 7	Ontario Hydro	750	55	Jul 1986
Bruce 8	Ontario Hydro	750	45	Jan 1987
Darlington 2	Ontario Hydro	880	20	May 1988
Darlington 1	Ontario Hydro	880	0	Feb 1989
Darlington 3	Ontario Hydro	880	0	Nov 1991
Darlington 4	Ontario Hydro	880	0	Aug 1992
Point Lepreau 2	New Brunswick EPC	630	0	indefinite
Total Under Construction and Planned		6,630		

[1]CODs from *Nuclear News* World list and other published sources.

cracking that led to the shutting down of Pickering Units 1 and 2 for an indefinite period of time.

The utility shut down Pickering Unit 2 in August following a six foot rupture in one of the unit's pressure tubes that caused a radioactive water leak to reach Lake Ontario. Tube sagging has been a recognized problem for some time; it can cause contact between hot pressure tubes and cold surrounding tubes that indirectly leads to tube wall corrosion and cracking. Pickering Unit 1 was shut down in November for an examination of its tubes, and two of four tubes withdrawn showed signs of cracking. Pickering Units 3 and 4 will be shut down early this year to check for similar problems. While it is not clear when Units 1 and 2 will be operating again, if Ontario Hydro decides that retubing is necessary they could be shut down for two or more years.

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ANNUAL REVIEW

JAPAN

Introduction

Although Japan's nuclear generating plan for the next decade was reduced by more than 10,000 MWe during 1983, the nation's commercial nuclear power program experienced a relatively problem-free year. The 24 commercial units listed in Table 10, which represent a generating capacity of 17,177 MWe, achieved excellent performance records. During 1983 three new units began low power testing (Table 10), while construction on scheduled units proceeded smoothly (Table 11).

Operational Capacity

Japan's commercial nuclear power plants established new records for availability and power generation in 1983. Over a six-month period the 24 units averaged greater than 70 percent availability, and in August, during the period of peak electricity demand for air conditioning, they achieved an 80.6 percent availability record. Nuclear power, which represents only 13 percent of Japan's total electricity generating capacity, accounted for approximately 20 percent of total generation.

Construction and Licensing

Table 11 lists ten units under construction, and seven units currently undergoing licensing, which means they have been approved by Japan's Electric Power Resources Development Coordination Council (EPRDCC). Of those seventeen reactors, scheduled commercial operation dates for seven were delayed six months or more during 1983 due to revisions of load growth forecasts and delays in licensing. Three commercial units received construction licenses during 1983 (Tokyo EPC's Kashiwazaki Units 2 and 5 and Chugoku EPC's Shimane Unit 2); Power Reactor and Nuclear Fuels Development Corporation (PNC) also received a construction license for the Monju 280-MWe Fast Breeder Reactor.

Approval of Kashiwazaki Units 2 and 5 was particularly significant because those units reflect the growing emphasis in Japan on plant standardization. Kashiwazaki Units 2 and 5 basically are duplicates of Tokyo EPC's Fukushima Units II-3 and II-4, which are also under construction. The utility is using the Fukushima engineering designs for the Kashiwazaki units and has standardized components and construction techniques.

Forecast Revisions

In early 1983 the Japanese government maintained an optimistic nuclear generation target of 46,000 MWe by the end of FY1990. Utilities at the time suggested approximately 37,000 MWe as a more realistic target. In October, the Ministry of International Trade and Industry (MITI), which is responsible for government policy for nuclear generation of electricity, drastically reduced the official national target to 34,000 MWe. Three reasons supported the revised target:

1. Greater energy conservation than anticipated;
2. Reduced projections of economic growth;
3. Expected continuation of low and stable oil prices.

Despite reducing the FY90 target for installed nuclear generating capacity, MITI stressed the need for Japan to continue to develop nuclear power aggressively. The official plan calls for the following capacity targets:

FY1990: 34,000 MWe
FY1995: 48,000 MWe
FY2000: 62,000 MWe.

The long-term goals are ambitious, so further revisions are likely in future years.

Uranium Inventories

Cutbacks in Japan's nuclear generation targets have had the effect of increasing the utilities' relative inventory levels and degree of coverage under current contract commitments. Most contracts between Japanese buyers and overseas uranium producers were signed during the 1970s and involve long-term commitments. Contracted quantities were intended to support the optimistic nuclear generation forecasts prevalent at that time. In 1974 the official government plan called for 48,000 MWe of installed nuclear capacity *by 1985*.

The current Japanese uranium supply situation is sufficient to meet the nation's requirements at least through the mid-1990s (Report 179 of July 1983). Existing utility inventories amount to between five and ten years of forward consumption. Although such large inventories are a financial burden under normal circumstances, the Japanese utilities have not expressed much interest in reducing inventory levels or supply commitments. Generally the benefits of long-term security of supply have outweighed potential gains from near-term financial expediency. In addition, because spot market prices are currently far below the prices the utilities are obligated to pay under existing contracts, and because the government must approve any resale of uranium, spot market participation has not seemed particularly attractive to the utilities.

Nevertheless, there were some indications during 1983 that certain Japanese utilities may be prepared to rationalize their uranium procurement programs. Three strategies for accomplishing this objective seem feasible under current conditions.

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Table 10

OPERATIONAL NUCLEAR POWER UNITS: JAPAN

Unit	Utility	Capacity (MWe net)	Type	Commercial Operation
In Commercial Operation				
Tokai 1	JAPC[1]	166	GCR	Jul 1966
Tsuruga	JAPC	357	BWR	Mar 1970
Mihama 1	Kansai EPC[2]	340	PWR	Nov 1970
Fukushima I-1	Tokyo EPC	460	BWR	Mar 1971
Mihama 2	Kansai EPC	500	PWR	Jul 1972
Shimane 1	Chugoku EPC	460	BWR	Mar 1974
Fukushima I-2	Tokyo EPC	784	BWR	Jul 1974
Takahama 1	Kansai EPC	826	PWR	Nov 1974
Genkai 1	Kyushu EPC	559	PWR	Oct 1975
Takahama 2	Kansai EPC	826	PWR	Nov 1975
Fukushima I-3	Tokyo EPC	784	BWR	Mar 1976
Hamaoka 1	Chubu EPC	540	BWR	Mar 1976
Mihama 3	Kansai EPC	826	PWR	Dec 1976
Ikata 1	Shikoku EPC	566	PWR	Sep 1977
Fukushima I-5	Tokyo EPC	784	BWR	Apr 1978
Fukushima I-4	Tokyo EPC	784	BWR	Oct 1978
Tokai 2	JAPC	1100	BWR	Nov 1978
Hamaoka 2	Chubu EPC	840	BWR	Nov 1978
Ohi 1	Kansai EPC	1175	PWR	Mar 1979
Fukushima I-6	Tokyo EPC	1100	BWR	Oct 1979
Ohi 2	Kansai EPC	1175	PWR	Dec 1979
Genkai 2	Kyushu EPC	559	PWR	Mar 1981
Ikata 2	Shikoku EPC	566	PWR	Mar 1982
Fukushima II-1	Tokyo EPC	1100	BWR	Apr 1982
Total in Commercial Operation		17,177		
Fuel Loaded in 1983				
Fukushima II-2	Tokyo EPC	1100	BWR	Feb 1984 (est.)
Onagawa 1	Tohoku EPC	524	BWR	Jun 1984 (est.)
Sendai 1	Kyushu EPC	890	PWR	Jul 1984 (est.)
TOTAL MWe		19,691		

[1]JAPC = Japan Atomic Power Company.
[2]EPC = Electric Power Company.

1. The utilities could negotiate some form of contract relief from present suppliers, for example by reducing annual deliveries and lengthening contract durations.

2. The utilities could adopt a tougher negotiating posture during price negotiations, which under most contracts occur annually for the following year's deliveries. In recent years the utilities have obtained significant reductions in contract prices because of market price weakness. Prices negotiated in 1983 for 1984 deliveries were in the $33-34 range.

3. The utilities could balance individual inventory levels by exchanging uranium among themselves. Alternately, they might urge the government to establish a national uranium stockpile.

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Table 11

JAPANESE NUCLEAR POWER UNITS
UNDER CONSTRUCTION AND UNDERGOING LICENSING

Unit	Utility	Capacity (MWe net)	Type	Estimated Commercial Operation
Under Construction				
Takahama 3	Kansai EPC	870	PWR	Feb 1985
Fukushima II-3	Tokyo EPC	1100	BWR	Jul 1985
Takahama 4	Kansai EPC	870	PWR	Aug 1985
Kashiwazaki 1	Tokyo EPC	1100	BWR	Oct 1985
Sendai 2	Kyushu EPC	890	PWR	Mar 1986
Tsuruga 2	JAPC	1160	PWR	Jun 1987
Hamaoka 3	Chubu EPC	1100	BWR	Sep 1987
Fukushima II-4	Tokyo EPC	1100	BWR	Sep 1987
Kashiwazaki 5	Tokyo EPC	1100	BWR	Apr 1990
Kashiwazaki 2	Tokyo EPC	1100	BWR	Oct 1990
Undergoing Licensing				
Shimane 2	Chugoku EPC	820	BWR	Sep 1988
Kyowa Tomari 1	Hokkaido EPC	579	PWR	Dec 1988
Ikata 3	Shikoku EPC	890	PWR	Oct 1990
Kyowa Tomari 2	Hokkaido EPC	579	PWR	Dec 1990
Genkai 3	Kyushu EPC	1180	PWR	Oct 1991
Maki	Tohoku EPC	825	BWR	Dec 1991
Genkai 4	Kyushu EPC	1180	PWR	Oct 1992
TOTAL MWe		16,443		

Enrichment Services

While the Japanese utilities have contracts with Eurodif to supply approximately one million SWUs per year, they purchase most enrichment services from DOE. The utilities gave considerable attention to DOE's enrichment contract offers during 1983. Those offers included the draft Facility Requirements contract, the Interim Sales contract (ISC), the modified ISC, and the draft Utility Services enrichment contract (USEC). The Japanese did not participate actively in the secondary SWU market during 1983.

Close cooperation between the USA and Japan on trade matters has fostered a stable commitment on the part of the Japanese utilities to DOE. In the early 1970s an agreement between the two nations that aimed to reduce Japan's large trade surplus with the USA enabled Japanese utilities to purchase in advance 8 million SWUs for future deliveries at relatively low prices. By the end of 1983, 4 million of those SWUs remained to be delivered. Most are believed to be included in the terms of the Adjustable, Fixed-commitment (AFC) contracts that make up the majority of enrichment contracts between Japanese utilities and DOE. Therefore, despite considerable efforts by Eurodif and Urenco to attract Japanese enrichment business, DOE will continue to be the dominant supplier. Nevertheless, the Japanese utilities are looking at DOE's recent enrichment offers carefully.

The Japanese government has urged the nuclear utilities to proceed aggressively with the financing of a private company to develop and operate a full-scale centrifuge enrichment plant by the 1990s. Production of 1 million SWUs is planned for 1995 and 3 million SWUs by the year 2000. However, the utilities are unlikely to make the near-term capital investment necessary to fulfill those objectives. Overseas enrichment supplies appear adequate for the foreseeable future, particularly in light of the recently reduced forecasts of installed nuclear generating capacity.

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PNC has been operating a pilot-scale centrifuge enrichment plant (50,000 SWUs per year) at Ningyo-Toge in Okayama Prefecture since March 1982. Preparation is underway for construction at the same site of a demonstration plant having the capacity to produce 200,000 SWUs per year. The first increment of capacity (100,000 SWUs per year) is scheduled to begin operations in 1987, and full capacity operations are scheduled to begin in 1988.

Fuel Reprocessing

As for enrichment, the schedule for a full-scale domestic reprocessing plant is likely to suffer from the 1983 cutbacks in projected nuclear generating capacity. PNC had reprocessed a number of batches of spent LWR fuel using its existing 700 kg per day demonstration plant at Tokaimura, but in 1983 the plant shut down because of dissolver problems. While partial operation may resume early this year, the demonstration plant is unlikely to operate at full capacity for several years. The Japanese nuclear utilities organized Japan Nuclear Fuel Services Company for the purpose of building a 1000 ton per year reprocessing plant modeled on the PNC operation, but the original schedule for commercial operation in the early 1990s is unlikely to be met.

REPUBLIC OF SOUTH AFRICA

Overview

The Republic of South Africa continued to be a stable and reliable uranium producer during 1983 despite economic problems. Low gold and uranium prices in the international markets, severe drought in Southern Africa and cuts in South Africa's nuclear generation plan did not prevent U_3O_8 output from rising, as uranium producers continued their profitable operations.

The passing of a national referendum in November extending voting rights to citizens classified as coloured under South Africa's apartheid laws was interpreted internationally as a positive move by the white electorate. Earlier in the year, the Chamber of Mines recognized black trade unions and union leadership participated in wage negotiations for the first time. There appears to be a feeling within South Africa that closer relations between industry and labor will lead to greater benefits for blacks and a more stable workforce for the mining industry.

While some encouraging developments occurred during 1983, conflicts between South Africa and neighboring Angola and Mozambique pointed up the continuing political difficulties of Southern Africa in general. The growth in size of the outlawed African National Congress (ANC), and what seemed to be greater international recognition and support for the group, raised some questions internationally about the duration of relative political and economic stability.

Nuclear Power

The Electricity Supply Commission of South Africa (Escom) concluded in its 1983 review of generation expansion plans that no nuclear units other than the twin Koeberg PWRs near Capetown are likely to be operational before the end of the century. The Koeberg plant, which was in the final stages of construction late in 1982 when an ANC bomb exploded at the site, should begin to produce electricity during 1984. Other plans for nuclear plants have been scrapped primarily because of low coal costs and declining demand for electricity.

Escom currently has under construction several coal-fired generating stations that will fill electricity demand in the country's interior well into the coming century. Coal is remarkably inexpensive in the South African interior. Nuclear power stations along the coast could be competitive with coal stations because of high coal transportation costs, but electricity demand on the coast comprises only 25 percent of the country's total. Furthermore, electricity growth rates dropped substantially during 1982 and 1983, from a previous annual average of approximately 7 percent to approximately 2 percent.

Uranium Production

The South African uranium production industry managed to do well in 1983 despite low dollar prices for gold and uranium concentrates. All uranium-gold facilities continued profitable operations. Four general factors help to explain the stability of the industry.

1. Long-term uranium contracts concluded in previous years continued to absorb production, and while prices under long-term contracts may have declined somewhat during 1983, they remained well above spot market prices.

2. South Africa's contracts customarily are denominated in US dollars, so the declining Rand/US Dollar currency exchange rate acted to mitigate some of the effects of depressed worldwide demand for uranium.

3. Most South African producers have the flexibility to vary grades and throughput to meet particular operational and market circumstances.

4. By-product and co-product uranium production from gold mining in general costs less than primary uranium production.

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Table 12 shows a breakdown of uranium production among thirteen operations in South Africa during 1983 (the figures for Palabora Mining Company (PMC) are not yet available). Total production, excluding PMC, of 15.3 million pounds U_3O_8 in 1983 exceeded by 5 percent the 1982 level of 14.6 million pounds. For five producers output declined from 1982 levels; JMS alone cut production by 317 thousand pounds. However, eight producers increased production. More than 75 percent of the increases came from three operations: Beisa (up 443 thousand pounds), Vaal Reefs (up 334 thousand pounds), and Western Areas (up 247 thousand pounds). The Western Areas and Beisa mines are relatively new operations building up production. Actual 1983 production from South Africa was 1.6 percent higher than Nuexco's forecast of 15.0 million pounds U_3O_8 excluding PMC.

Specific Comments on Production Operations

Beisa (St. Helena). The Beisa uranium/gold mine, which St. Helena Gold Mines Ltd. purchased in 1980, increased U_3O_8 production by 79 percent in 1983. Output during 1982, the first full year of production, had been hampered by numerous intersections of water. Rated capacity of 220 million pounds of ore per month nearly was achieved in the fourth quarter of 1983.

Blyvooruitzicht. Production in the fourth quarter fell by 28 percent as lower-grade surface slimes were processed. Nevertheless, total 1983 U_3O_8 production increased 15 percent over 1982. By-product uranium output may continue into 1985 until the U_3O_8 stockpile is sufficient to supply outstanding contract commitments. The operators are considering more profitable stockpile options than production, however, which means plant operation may cease within the year.

Buffelsfontein. Fourth quarter production and annual production both rose 5 percent due to mining of higher grade ore. In the fourth quarter construction was completed on the 440 million pound per month sub-vertical shaft system to the Lucas block area of the deposit. Buffelsfontein now owns a 20 percent stake in Chemwes.

Chemwes (Stilfontein). Stilfontein Gold Mining Ltd. is the parent company of Chemwes, which produced 7 percent less U_3O_8 in 1983 than in 1982. The decrease was attributed to treatment of lower grades pursuant to the depletion of higher grade slimes from Buffelsfontein.

Driefontein. Processing of higher grade ore increased U_3O_8 output 28 percent in the fourth quarter, but failed to make up for lower grades processed during mid-year. Annual production dropped 22 percent from the 1982 level. Driefontein is a rich, long-life mine that has the flexbility to achieve high grades in times of low gold prices.

Table 12

REPUBLIC OF SOUTH AFRICA:
1983 URANIUM PRODUCTION
(Thousands of Pounds U_3O_8)

Operation	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Total 1983
Beisa (St. Helena)	198	233	267	305	1,003
Blyvooruitzicht	149	185	180	127	641
Buffelsfontein	304	342	337	362	1,345
Chemwes (Stilfontein)	268	297	320	360	1,245
Driefontein Consolidated	108	88	85	105	386
ERGO[1]	143	134	124	106	507
Harmony	366	363	335	310	1,374
Hartebeestfontein	234	241	252	246	973
JMS[2]	371	384	411	420	1,586
Randfontein	270	262	270	281	1,083
Vaal Reefs	1,018	1,083	1,042	996	4,139
Western Areas	132	158	170	164	624
Western Deep Levels	94	94	107	89	384
TOTALS	3,655	3,864	3,900	3,871	15,290

[1]ERGO = East Rand Gold and Uranium Co. Ltd.
[2]JMS = Free State Joint Metallurgical Scheme.

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East Rand Gold and Uranium Co. Ltd. (ERGO). Fourth quarter and annual production declined 15 percent and 13 percent respectively after higher grade slime reserves were depleted. New dams with lower grade ore have led to lower production rates. The new Simmergo treatment plant began operating in 1983.

Harmony. Annual production rose 6 percent in 1983 to set a record for U_3O_8 output. Because Harmony is among the largest gold mines, it has remained profitable even when processing very low grade ore. However, the company has indicated that U_3O_8 production may be curtailed unless spot prices show signs of improvement.

Hartebeestfontein. Production remained constant throughout 1983 from this stable producer.

Free State Joint Metallurgical Scheme (JMS). U_3O_8 output for the fourth quarter remained constant, but annual production fell 17 percent as a result of continued changes to the feed mix and reductions in the grade of slimes treated during the year.

Randfontein. Production for the fourth quarter rose 4 percent and for the year rose 6 percent as tonnage throughput increased following extensions to the uranium section of the Cooke plant, which now has a throughput capacity of 300 thousand tonnes per month. Randfontein acquired mining rights in 1983 to an area northeast of Cooke known as Doornkop, and began planning for a major expansion that includes 50 thousand tonnes per month additional capacity at the Cooke plant by mid-1985.

Vaal Reefs. Fourth quarter production fell 4 percent due to lower grades treated from the North Lease area and lower tonnage treated from the South Lease area. 1983 production rose 9 percent, however, as higher grades from the South Lease area contributed more to the operation overall. Profits from U_3O_8 sales jumped 182 percent in the final quarter (to R26.8 million) and 83 percent, to R55.5 million, for the year. Vaal Reefs consistently shows higher uranium profits in the fourth quarter because of contract delivery schedules. Profits for the year are the highest since 1979 (R61.8 million), indicating significant new sales in 1983.

Western Areas. While fourth quarter production changed little, output for the year increased 66 percent over 1982, reflecting the new plant's build-up to rated capacity.

Western Deep Levels. Throughput in general dropped during 1983, bringing production down five percent from 1982. Fourth quarter production dropped 17 percent as both grade and tonnage levels fell. Western Deep Levels continued work on a major expansion in the south of the lease area during 1983.

UNITED STATES

Introduction

US utility nuclear power programs in general had a difficult year in 1983, as did the US uranium production sector. Financial and regulatory problems plagued nuclear plant construction as they have for several years. A sense of recovery or stabilization seemed to characterize the first half of the year, but at year-end renewed pessimism emerged. The failing health of many US nuclear power programs reflected back on the nuclear fuel market and domestic uranium activities. Several producers reduced production and four facilities were shut down altogether.

Nuclear Power

Construction delays and financial difficulties altered several utilities' long-range forecasts for commercial operation during 1983. Sixteen units were delayed for at least one year, two were deferred indefinitely (tantamount to cancellation) and seven were cancelled outright (Table 13). (While the official announcement of Public Service of Indiana's cancellation of its two Marble Hill units came in January 1984, the action was evident in December 1983.) The total generating capacity cancelled amounted to 7,923 MWe, one-fourth the amount cancelled in 1982. Nuexco estimates that at least 13 additional reactors now under construction or on order eventually will be cancelled. Those cancellations, if they take place, will remove approximately 15,220 MWe of generating capacity and approximately 4.3 million pounds U_3O_8 of potential average annual consumption from the portion of the US nuclear power base once thought secure.

While the general climate for nuclear plant construction did not improve markedly during 1983, four reactors, representing a total capacity of 3,727 MWe, did begin commercial operation during the year. In addition, one fuel loading and low power testing license, two low power operating licenses and two full power operating licenses were issued, adding 5,442 MWe to US nuclear generating capacity. Table 14 summarizes the licensing progress of US nuclear units during 1983.

Table 15 lists US reactors under construction in descending order of completion percentage, as of December 31, 1983. A survey by the Atomic Industrial Forum indicated that 14 reactors may receive operating licenses during 1984, representing a total of 15,544 MWe.

Legislation Regarding Uranium

Faced with weak prices and little demand, US producers continued to seek relief from the US government, asking Congress to reimpose limitations on the import of

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Table 13

US NUCLEAR UNITS DELAYED, DEFERRED AND CANCELLED IN 1983

Unit	Utility	MWe (net)	Type	Delay From	Delay To	Months Deiayed
Delayed at least one year						
Grand Gulf 1	Middle South	1250	BWR	2 83	9 84	19
Waterford 3	Louisiana P&L	1104	PWR	7 83	12 84	17
Fermi 2	Detroit Ed.	1100	BWR	11 83	12 84	13
Shoreham	LILCO	820	BWR	3 83	1 85	22
Perry 1	Cleveland Elec.	1205	BWR	5 84	5 85	12
Palo Verde 1	Arizona PS	1270	PWR	5 83	10 85	29
Seabrook 1	PS New Hampshire	1150	PWR	2 84	12 85	22
Palo Verde 2	Arizona PS	1270	PWR	5 84	1 86	20
Midland 1	Consumers Power	530	PWR	7 84	6 86	23
Midland 2	Consumers Power	805	PWR	12 83	6 86	30
Clinton 1	Illinois Power	933	BWR	8 84	11 87	39
Seabrook 2	PS New Hampshire	1150	PWR	5 86	12 87	19
Bellefonte 2	TVA	1213	PWR	11 86	11 88	24
South Texas 2	Houston L&P	1250	PWR	86	6 89	30
Carroll County 1	Comm. Edison	1120	PWR	99	2001	12+
Carroll County 2	Comm. Edison	1120	PWR	2000	2002	12+
Indefinitely Deferred						
Zimmer	Cincinnati G&E	810	BWR	84	indefinite	
WNP3	WPPSS	1240	PWR	12 86	indefinite	
TOTAL MWe Delayed and Deferred		19,340				
Cancelled					**Percent Complete**	
Marble Hill 1	PS Indiana	1130	PWR		55	
Marble Hill 2	PS Indiana	1130	PWR		35	
Cherokee 1	Duke Power	1280	PWR		18	
Harris 2	Carolina P&L	900	PWR		4	
Clinton 2	Illinois Power	933	BWR		0	
Skaget-Hanford 1	Puget Sound P&L	1275	BWR		0	
Skaget-Hanford 2	Puget Sound P&L	1275	BWR		0	
TOTAL MWe Cancelled		7,923				

non-US uranium. Their efforts resulted in new legislation which provides for a periodic review of the viability of the US uranium mining industry. The purpose of the review, however, is to ensure the national security of tne USA rather than the prosperity of the domestic uranium industry.

Based on the legislation, the Energy Information Administration (EIA) of the US Department of Energy (DOE) will compile an annual report on the US uranium industry for submission to the Secretary of Energy. EIA has published a number of criteria that will be used in assessing the viability of the industry. These include:

1. the current extent of US uranium resources;
2. US producer supply response capabilities based on current uranium production activities;
3. financial capabilities of US uranium producers;

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Table 14

US NUCLEAR UNITS NEARING COMMERCIAL OPERATION IN 1983

Unit	Utility	MWe net	Type	COD[1]
Commercial Operation				
Susquehanna 1	Penn. P&L	1050	BWR	Jun 1983
San Onofre 2	So. Cal. Ed.	1000	PWR	Aug 1983
St. Lucie 2	Florida P&L	777	PWR	Aug 1983
Summer 1	So. Carolina E&G	900	PWR	Jan 1984
Full Power Operating Licenses				
McGuire 2	Duke	1180	PWR	Jun 1984
San Onofre 3	So. Cal. Ed.	1000	PWR	Dec 1984
Low Power Operating Licenses				
LaSalle 2	Comm. Edison	1078	BWR	Dec 1984
WNP 2	WPPSS	1100	BWR	Dec 1984
Fuel Loading and Low Power Testing Licenses				
Diable Canyon 1	Pacific G&E	1084	PWR	Jun 1984
TOTAL MWe		9,169		

[1]Commercial Operating Date, based on published information and utility forecasts.

4. the strength and reliability of non-US supply commitments to the USA.

It appears doubtful that the new legislation will have any near-term impact on sales of non-US origin uranium to US utilities.

Uranium Production

US uranium production declined from 26.8 million pounds in 1982 to approximately 20.6 million pounds during 1983. Relatively low spot prices forced several producers to scale back production. Four facilities, representing a total production capacity of approximately 5.5 million pounds U_3O_8 per year, either closed permanently or shut down pending a rise in prices. Some of those closures followed completion of older contracts signed at high prices, and subsequent failure to conclude new contracts on economical terms.

A number of large multinational firms continued a recent trend by exiting the uranium production business and disposing of their uranium properties. Concurrently, a number of smaller organizations acquired uranium holdings. Low prices and weak demand affected particularly the larger, capital-intensive developments typically undertaken by large organizations. By focusing on smaller projects, smaller firms have shown an ability to produce at lower costs and to respond more rapidly to the market.

Outlook for 1984

The trends evident in 1983 are likely to persist in 1984, as the US nuclear power program continues to combat financial and regulatory obstacles and as excesses of uranium and fuel cycle services continue to be liquidated into an already glutted market. With additional plant cancellations, and with production exceeding consumption worldwide, it seems likely that 1984 will witness a continuation of the current buyer's market for all materials and services in the front end of the fuel cycle.

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Table 15

US NUCLEAR UNITS UNDER CONSTRUCTION AND ON ORDER

Unit	Utility	MWe (net)	Type	Percent Complete	COD[1]
Grand Gulf 1	Middle South	1250	BWR	99	Sep 1984
Palo Verde 1	Arizona PS	1270	PWR	99	Oct 1985
Zimmer 1	Cincinnati G&E	810	BWR	98	indefinite
Waterford 3	Louisiana P&L	1104	PWR	98	Dec 1984
Palo Verde 2	Arizona PS	1270	PWR	98	Jan 1986
Comanche Peak 1	Texas Utilities	1150	PWR	96	Dec 1984
Watts Bar 1	TVA	1177	PWR	95	Jul 1984
Fermi 2	Detroit Edison	1100	BWR	95	Dec 1984
Catawba 1	Duke Power	1145	PWR	94	Jun 1985
Susquehanna 2	Penn. P&L	1050	BWR	92	Nov 1984
Diablo Canyon 2	Pacific G&E	1106	PWR	91	Nov 1984
Shoreham	Long Island Lighting	820	BWR	90	Jan 1985
Callaway 1	Union Electric	1150	PWR	90	Jan 1985
Wolf Creek	Kansas G&E	1150	PWR	87	Feb 1985
Byron 1	Commonwealth Edison	1120	PWR	86	Feb 1984
Limerick 1	Phil. Electric	1055	BWR	86	Apr 1985
Midland 1	Consumers Power	530	PWR	85	Jun 1986
Midland 2	Consumers Power	805	PWR	85	Jun 1986
Perry 1	Cleveland Electric	1205	BWR	84	May 1985
Bellefonte 1	TVA	1213	PWR	83	Nov 1988
Clinton 1	Illinois Power	933	BWR	81	Nov 1987
Seabrook 1	PS New Hampshire	1150	PWR	81	Dec 1985
Shearon Harris 1	Carolina P&L	900	PWR	79	Mar 1986
WNP 3	WPPSS	1240	PWR	75	indefinite
Millstone 3	Northeast Utilities	1150	PWR	72	May 1986
Hope Creek 1	PS Electric & Gas	1170	BWR	71	Dec 1986
River Bend 1	Gulf States Utilities	940	BWR	71	Dec 1985
Nine Mile Pt. 2	Niagara Mohawk	1080	BWR	70	Oct 1986
Byron 2	Commonwealth Edison	1120	PWR	69	Feb 1985
Braidwood 1	Commonwealth Edison	1120	PWR	68	Oct 1985
Beaver Valley 2	Duquesne	833	PWR	68	May 1986
Palo Verde 3	Arizona PS	1270	PWR	65	Oct 1986
Comanche Peak 2	Texas Utilities	1150	PWR	63	Dec 1985
Bellefonte 2	TVA	1213	PWR	63	Nov 1988
WNP 1	WPPSS	1250	PWR	63	indefinite
Watts Bar 2	TVA	1177	PWR	56	Jan 1986
Braidwood 2	Commonwealth Edison	1120	PWR	53	Oct 1986
Catawba 2	Duke Power	1145	PWR	52	Jun 1987
Vogtle 1	Georgia Power	1100	PWR	51	Mar 1987
South Texas 1	Houston L&P	1250	PWR	47	Jun 1987
Hartsville A1	TVA	1233	BWR	44	indefinite
Perry 2	Cleveland Electric	1205	BWR	38	May 1988
Hartsville A2	TVA	1233	BWR	34	indefinite
Limerick 2	Phil. Electric	1055	BWR	30	Oct 1988
Grand Gulf 2	Middle South	1250	BWR	25	indefinite
Seabrook 2	PS New Hampshire	1150	PWR	23	Dec 1987
South Texas 2	Houston L&P	1250	PWR	23	Jun 1989
Vogtle 2	Georgia Power	1100	PWR	16	Sep 1988
Carroll County 1	Commonwealth Edison	1120	PWR	0	2001
Carroll County 2	Commonwealth Edison	1120	PWR	0	2002
River Bend 2	Gulf States Utilities	940	BWR	0	indefinite

[1]Commercial Operating Date, based on published information and utility forecasts.

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US URANIUM ACTIVITIES

Introduction

The steady decline in uranium mining and exploration that occurred in 1982 continued during 1983, as the market for U_3O_8 failed to show a strong recovery. A brief market turnaround in fourth quarter 1982 and first half 1983, which followed spot market lows near $17, led to some stabilization of uranium activities. However, a year-end price downturn reinstituted further curtailment.

Total US U_3O_8 production dropped more than five million pounds from 1982, to an estimated 20.6 million pounds. Two production centers shut down in the first quarter of 1983. As a moderate price recovery seemed to be underway by mid-year, two milling operations that had been idle for a year or more resumed production on a limited basis. However, a third production center closed in October, and a fourth in December, and fourth quarter output was the lowest of 1983.

Nuexco estimates exploration and development drilling for the year at 3.0–3.5 million feet, down 45 to 50 percent from the 6.1 million feet drilled in 1982. The drilling rate was down in all areas of activity for the third straight year. Estimated 1983 drilling was approximately 93 percent below the record high of 47 million feet drilled in 1978. If the present drilling trend continues, the level of activity for 1984 may approach the low of 1.6 million feet drilled in 1952.

Active Projects

The main area for exploration activity during 1983 was once again to the north and south of Grand Canyon National Park, in the **Arizona Strip** (see Reports 163 and 176). Five companies conducted geophysical and geochemical programs and drilling in the search for uranium-bearing breccia pipes.

Energy Fuels Ltd. was most active, having nearly one million acres under control for exploration and mining purposes. It is the only company actually producing in the district. The company has four operating mines and a permit from the US Department of Interior to drill an exploration shaft on a fifth mineralized structure. The nature of mineral occurrence in breccia pipes is such that full evaluation by drilling from the surface can be an extremely difficult and expensive process. The exploration shaft will permit access to the ore zone for complete evaluation by underground drafting and drilling.

Further exploration and development activity was concentrated along known geologically favorable mineralized trends in various areas, including Duval, Brooks, and Kleberg counties in the **South Texas district.** Uranium Resources, Inc. outlined significant mineralization on its Kingsville Dome property near Kingsville in Kleberg County, and is planning to develop an in situ leach (ISL) recovery project in the near future. Everest Minerals Corporation installed an ISL pilot test at Mt. Lucas in Live Oak County, Texas in August, upgrading it to a commercial plant in November.

Continued exploration along the **Crow Butte** uranium trend in northwestern Nebraska succeeded in extending mineralization over a distance of at least 20 miles. Following the 1980 discovery of the Crow Butte uranium deposit near Crawford, Ferret Exploration Company independently initiated its Big Red exploration program in nearby areas of Dawes and Box Butte counties. Drilling during 1983 resulted in the apparent discovery of a major roll front uranium deposit. Important uranium reserves were identified over a trend-length of about 1.5 miles. The deposit represents the southward continuation of the Crow Butte trend. Ferret presently controls over 42,000 acres for exploration and mining in the area of interest.

The Crow Butte Joint Venture (owned half each by Wyoming Fuel Company and Ferret Exploration Company) determined that the Crow Butte deposit is amenable to solution mining techniques. The Joint Venture anticipates completion of licensing and permit procedures in early 1984, followed by construction and operation of a pilot solution mine and plant. Commercial production is anticipated in 1987.

The Commonwealth of Virginia evaluated an industry report on the benefits of developing the **Swanson Uranium Project** in Pittsylvania County. The evaluation concluded that a uranium development program by Marline Uranium Corporation, the lessee, could be carried out favorably within the guidelines of a well conceived and well implemented regulatory program. A special task force comprised of heads of various state agencies probably will propose regulatory guidelines in a study that is scheduled to be completed by late 1984.

Atlas Corporation of Moab, Utah announced further drilling success at its Bullfrog property located in **Southeastern Utah.** Uranium resources are sufficient to consider mining, according to Atlas management. Project feasibility studies indicate underground development would be compatible with the company's long-term uranium program. However, additional evaluation of the ore deposit remains to be completed prior to undertaking project development.

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Homestake Mining Company entered into an option agreement to earn a 50 percent interest in an ore deposit located near its mill at Ambrosia Lake, **New Mexico.** If the option is exercised, Homestake will finance and operate an underground mine. The property owner is Midas International Inc. of Pasadena, California and Milan, New Mexico. Mine development could begin by mid-1984 and ore production by late 1985 or early 1986.

With the exception of Everest Minerals' ISL plant in South Texas, almost no new projects commenced commercial operations during 1983. The Everest ISL pilot test on its Mt. Lucas property was a technical and economic success from the start. Production reached a commercial level of 1600 gallons per minute by late November. The plant is operating at full capacity and uranium recovery is at the level anticipated by Everest.

Other significant announcements and events that affected the US uranium industry in 1983 are listed chronologically in Table 16.

Table 16

1983 URANIUM RELATED ACTIVITIES IN THE USA

Month	Company/Entity	Event or Announcement
Jan	Energy Fuels	Suspended mill operations at White Mesa, near Blanding, Utah.
Mar	Everest Minerals	Purchased Exxon's Highland ore deposit, plus mine and mill buildings, Powder River Basin, Wyoming.
Mar	Minerals Expl. Co.	Announced plan to suspend production at its Sweetwater Project, Red Desert, Wyoming.
Mar	Homestake	Announced 2 month shut-down of its Grants, New Mexico mill, as of May 26.
Mar	Mobil	Received final approval from New Mexico EID agency for a new processing plant at Crownpoint, New Mexico.
Apr	US DOE	Announced 1982 U_3O_8 production was 26.9 million pounds at average grade of 0.12 percent.
Apr	Wyoming Mineral	Purchased Conoco's 50 percent interest in the Crownpoint, New Mexico project.
Apr	US Interior Dept.	Initiated litigation against Dawn Mining Co. over mining plans at the Midnight mine, Wellpinit, Washington.
Apr	Rocky Mt. Energy	Announced study in progress for open pit mining of four deposits in Weld County, Colorado. Milling would be done at Bear Creek, Powder River Basin, Wyoming.
May	Union Carbide	Announced intent to reopen the Uravan mill on a temporary schedule.
Jun	Pathfinder Mines	Started underground development off the south wall of the 2R South pit, Gas Hills district, Wyoming.
Jun	Minerals Expl. Co.	Suspended operations at its Sweetwater Project, Red Desert, Wyoming.
Jun	Conoco	Sold its Ruby Ranch project in the Powder River Basin, Wyoming, to Santa Fe Mining Inc.
Jun	Conoco	Closed its Denver-based minerals division.
Jun	Energy Fuels	Received authorization from the Interior Department to drill an exploration shaft on the Kanab North breccia pipe, Arizona Strip area.
Jul	Mobil	Mobil Alternative Energy, Inc., formed to administer all activities for uranium and other minerals.

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1983 URANIUM RELATED ACTIVITIES IN THE USA

Month	Company/Entity	Event or Announcement
Aug	Homestake	Will close the Pitch mine at year-end.
Aug	Homestake	Negotiating joint venture project near Grants, New Mexico with Midas International, Inc.
Aug	Rio Algom	Purchased the Mi Vida mine near La Sal, Utah. Production to resume in a few weeks.
Aug	Homestake	Increased production at the Grants, New Mexico mill from 17,000 tons per month to 25,000 tons.
Aug	Everest Minerals	Started up ISL pilot operation at its Mt. Lucas project, South Texas district.
Aug	AGIP Nucleaire	Announced plans to develop the Juniper Ridge deposits near Baggs, Wyoming.
Sep	Exxon Nuclear	To extend mine and mill operations at Highland, Wyoming until end of first quarter, 1984.
Oct	US DOE	Transferred the uranium industry viability study program from Grand Junction, Colorado to the Energy Information Administration in Washington, D.C.
Oct	Union Carbide	Closed its Uravan mill for an indefinite period.
Oct	Cotter Corp.	Announced tentative plan to start-up two or more mining operations in the Naturita, Colorado area.
Oct	Intercont. Energy	Acquired the mineral rights from Exxon for the tailings pond at Ray Point, Texas.
Oct	Kerr McGee	Reorganized its nuclear operations into two companies. All New Mexico operations to operate as Quivira Mining Co. All other nuclear-related operations to be known as Sequoyah Fuels Corp.
Oct	Union Carbide	Ninety-three employees were dismissed from the Uravan and Rifle, Colorado mills.
Oct	Homestake	Closed the Pitch mine about two months ahead of schedule.
Nov	Homestake	Formed Wind River Mining Co. for participation in a 50-50 joint venture with Rich Mining Co. to mine the Midas deposit near Grants, New Mexico.
Nov	Intercont. Energy	Announced plans to purchase the Lamprecht ISL project in South Texas from Wyoming Mineral Corp.
Nov	Rio Algom	Increased production at the Lisbon mill to 750 tons per day, 7 days per week.
Nov	Homestake	Dismissed forty employees at Grants, New Mexico operations.
Nov	Union Carbide	Dismissed 100 miners in the Uravan, Colorado mining district.
Nov	Atlas Corp.	Study in progress for mining the Bullfrog deposit in Southeastern Utah.
Dec	Union Carbide	Has lease agreement with Energy Fuels for 70 percent of capacity on the Blanding, Utah mill which may reopen in late 1984.
Dec	Union Carbide	Gas Hills, Wyoming mine and mill placed on standby, 104 employees dismissed.
Dec	Uranium Resources	Entered into joint venture exploration and mining program with a non-US company in the South Texas district.

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WORLD URANIUM PRODUCTION

Continuing a trend begun in 1982, world uranium production declined in 1983 by 7 percent from the previous year, to approximately 96 million pounds. Production declines in the USA, Australia and Canada more than offset increases in output from Africa, France and other regions. A comparison of Nuexco's production estimates for 1982 and 1983 is presented in Table 17.

Table 17

1983 WORLD URANIUM PRODUCTION
(millions of pounds U_3O_8)[1]

Country	1982	1983	Percent Change
Australia	11.6	8.4	-28
Canada	20.1	19.0	-5
France	6.6	8.5	+29
South Africa[2]	15.1	15.8	+5
Other Africa	20.9	21.2	+1
Other	1.6	2.3	+44
Subtotal	75.9	75.2	-1
United States	26.8	20.6	-23
TOTAL (rounded)	103.0	96.0	-7

[1]Nuexco estimates.
[2]Includes estimate for Palabora Mining Company.

South Africa was the only major producer country to show production increases during 1983 (see the *Annual Review* of South Africa in this Report). Production in Central Africa grew slightly, contrary to previous expectations. France brought Lodeve to capacity, thus showing growth in uranium output for a second year. With Brazil's Pocos de Caldas reaching capacity, the other countries category also showed a marked increase in production.

Australia, Canada and the USA all decreased output during 1983. Australian output declined because of the absence of production from Mary Kathleen, which was shut down late in 1982, and because Ranger closed down in the fourth quarter due to labor union problems. Canadian production declined despite the commissioning of Key Lake and the reopening of the Stanleigh mine because of the phasing out of older operations. US production declined for the third year in a row. The greatest cutbacks were in conventional mining, with in situ and by-product operations continue to be strong. The regional distribution of US production is shown in Table 18.

Table 18

US URANIUM PRODUCTION BY STATE
(millions of pounds U_3O_8)[1]

Mill Location	1983	Percent of Total 1983 Production
Wyoming	5.4	26
New Mexico	5.1	25
Texas	3.2	15
Utah	2.0	10
Others	4.9	24

[1]Nuexco estimate.

Nuexco anticipates an increase in world production in 1984. Canada's Key Lake is expected to reach its 12 million pounds U_3O_8 annual capacity by year end; Stanleigh will also increase output. Ranger in Australia should produce at capacity without interruption. As indicated in Table 19, a 6 percent increase is anticipated, with the only substantial decline in the USA.

Table 19

1984 WORLD PRODUCTION FORECAST
(millions of pounds U_3O_8)[1]

Country	1983	1984	Percent Change
Australia	8.4	10.5	+25
Canada	19.0	28.1	+48
France	8.5	8.0	-6
South Africa	15.8	16.2	+3
Other Africa	21.2	20.3	-4
Other	2.3	2.4	+4
Subtotal	75.2	85.5	+14
United States	20.6	16.0	-23
TOTAL (rounded)	96.0	102.0	+6

[1]Nuexco estimates.

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EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1979

Determined as of the last day of the month indicated

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HISTORICAL MARKET DATA

HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	35.20	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	**20.50**											

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	43.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	**23.05**											

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars/lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	**0.60**											

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AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage Earners, Weekly Rates[2] (1976=100)
1972 Avg.	105.6	71.3
1973 Avg.	124.4	79.0
1974 Avg.	141.9	108.1
1975 Avg.	150.4	132.6
1976 Avg.	168.4	160.9
1977 Avg.	192.0	179.0
1978 Avg.[3,4]	198.5	190.0
1979 Avg.	248.8	127.9
1980 Avg.	321.8	140.8
1981 Avg.	355.3	154.1
1982 Avg.[5]	368.6	174.9
Oct 1982	378.5	178.4
Nov 1982	375.9	178.5
Dec 1982	374.9	179.5
Jan 1983	385.7	179.6
Feb 1983	387.5	179.8R
Mar 1983	397.4	179.7R
Apr 1983	407.3	180.0R
May 1983	414.8	180.1R
Jun 1983	415.6	180.2R
Jul 1983	408.4	179.9R
Aug 1983	403.1	179.8R
Sep 1983	403.1	179.7R
Oct 1983	—	186.8R
Nov 1983	—	186.6P

P = Preliminary R = Revised since last month

[1]Australian Bureau of Statistics, Canberra: "Price Index of Materials Used in Manufacturing Industry" (Catalogue No. 6411.0).
[2]Australian Bureau of Statistics, Canberra: "Award Rates of Pay Indexes, Australia" (Catalogue No. 6312.0). Figures for the latest fourteen months shown are subject to revision.
[3]Monthly data for 1970-78 appear on pages 4.7 and 4.8 of Report 138.
[4]Annual averages prior to 1979 reflect index base no longer in use.
[5]Monthly data for 1979-82 appear on page 35 of Report 184.

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GOVERNMENT STATISTICS

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (CS)[2] Uranium Mines (SIC 057)	Metal Mines (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	(SIC 296-298)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 370-379)
1979 Avg.[6]	217.9	—	9.60	9.66	—	7.35	—	7.67
1980 Avg.	247.2	—	10.59	10.80	—	8.05	—	8.50
1981 Avg.	288.7	—	12.02	12.23	—	9.03	—	9.53
1982 Avg.[7]	288.8	—	13.74	13.92	—	9.98	—	10.63
1983 Avg.	298.7P	—	—	—	—	—	—	—
Oct 1982	292.1	—	13.83	13.89	—	10.18	—	10.86
Nov 1982	291.3	—	14.42	14.28	—	10.43	—	10.90
Dec 1982	292.3	—	14.54	14.32	—	10.55	—	11.06
Jan 1983	292.7	—	14.36	14.35	—	10.72	—	11.06
Feb 1983	293.5	—	14.24	14.28	—	10.74	—	11.06
Mar 1983[8]	295.2	16.79	14.84	14.48	—	10.93	—	11.21
Apr 1983	297.1	16.83	14.40	14.13	11.57	—	10.10	11.02
May 1983	298.5	17.02	14.50	14.10	11.39	—	9.82	10.97
Jun 1983	299.3	17.02	14.60	14.07	11.33	—	9.84	11.05
Jul 1983	300.4	16.48	14.35	13.93	11.70	—	9.83	11.04
Aug 1983	301.2	16.93	14.36	13.89	11.82	—	10.08	11.19
Sep 1983	301.0R	17.66	14.90	14.41	11.99	—	10.38R	11.29
Oct 1983	301.5R	17.73	15.27	14.65R	11.76R	—	10.03R	11.30R
Nov 1983	301.6R	16.07P	14.83P	14.49P	11.68P	—	10.60P	11.46P
Dec 1983	302.7P	—	—	—	—	—	—	—

P = Preliminary R = Revised since last month

[1]Statistics Canada, Prices Division, Ottawa: "Industry Price Indexes" (Catalogue 62-011). Indexes for the most recent six months shown are subject to revision.

[2]Statistics Canada, Labour Division, Employment and Payrolls Section, Ottawa: "Employment, Earnings and Hours" (Catalogue 72-002).

[3]Reports 175 through 185 list this series title incorrectly as "Metal Mining, Including Milling (SIC 050-099)".

[4]Beginning with the April 1983 figure, Primary Metal Industries, non-ferrous is split into SIC 296 and SIC 298.

[5]Chemical and Chemical Products prior to April 1983 was SIC 370-379. The new series is from a new survey which includes all companies and is based on a 1970 classification. The old survey only included companies of 20 employees or more.

[6]Monthly ISPI for 1977 and 1978 appear on page 4.10 of Report 138, and monthly wage-earner data for 1973-78 appear on page 4.11 of Report 138.

[7]Monthly data for 1979-1982 appear on page 37 of Report 184. On that page, the wage earner index entitled "Metal Mining, Including Milling (SIC 050-099)" should read "Total Mining (SIC 051-099)".

[8]Beginning with the March 1983 figure, Wage Earner Data are based on a census of all companies employing 200 or more wage earners, *plus* a random survey of companies employing fewer than 200 wage earners. Prior to March 1983 only companies employing fewer than 200 wage earners are included in the Wage Earner Data.

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REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per Metric Ton of Gold Ore Milled (Rand)[1]	Consumer Price Index[2] (1975 = 100)	Producer Price Index All Groups[4] (1975=100)[5]	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1972 Avg.	8.79	113.3	63.9	623,067	443,933
1973 Avg.	10.51	124.1	72.3	684,743	572,133
1974 Avg.	13.18	138.5	85.3	674,140	761,596
1975 Avg.	16.71	157.2	100.0	639,473	1,003,617
1976 Avg.	19.30	174.7	115.1	671,240	1,212,983
1977 Avg.	23.87	194.4	130.0	712,006	1,420,670
1978 Avg.	27.14	137.2	142.7	664,571	1,537,169
1979 Avg.[6]	30.18	155.3	164.5	692,209	1,830,632
1980 Avg.[7]	35.53	176.7	192.1	714,379	2,279,615
1981 Avg.	41.89	206.5	218.3	728,506	2,820,505
1982 Avg.[8]	47.25	233.5	248.7	707,552	3,246,071
1983 Avg.		262.2 P			
Oct 1982		243.9	260.1	701,316	285,328
Nov 1982		245.4	262.5	707,966	287,699
Dec 1982	49.62	246.2	263.0	683,982	288,019
Jan 1983		249.0	264.9	688,030	289,075
Feb 1983		253.1	267.4	697,089	281,413
Mar 1983	50.35	255.9	269.1	695,976	290,586
Apr 1983		257.8	270.9	697,158	286,708
May 1983		259.7	274.1	701,712	295,701
Jun 1983	50.51	260.8	273.1	706,933	300,177
Jul 1983		262.5	273.7	704,202	314,566
Aug 1983		265.6	278.9	698,984	311,789
Sep 1983	52.92	267.3	279.4	696,435	312,264
Oct 1983		270.0	281.0		
Nov 1983		271.4	281.6		
Dec 1983		273.2			

[1]Chamber of Mines of South Africa, Johannesburg; "Analysis of Working Results," published quarterly. The tonnage-weight index of average working costs per metric ton of gold ore milled for 1983 follows. (Base: March quarter 1982 = 100). See page 16 of Report 178 for the description and calculation of index, and page 24 of Report 178 for figures for 1982.

1983:	January-March	111.2
	April-June	111.9
	July-September	117.4

[2]Republic of South Africa Department of Statistics, Pretoria; "Government Gazette: Consumer Price Index for Urban Areas."
[3]For annual averages prior to 1978, April 1970 = 100.
[4]Previously known as the Wholesale Price Index, now the Producer Price Index. The computation remains the same.
[5]Bulletin of Statistics, Department of Statistics, Pretoria.
[6]Historical data for the Average Declared Working Costs and Consumer Price Index 1970-1979 appear on page 49 of Report 140.
[7]Monthly data for Codes 35 and 40, 1977-1980, appear on page 28 of Report 157.
[8]Monthly data for 1979-82 appear on page 39 of Report 184.

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GOVERNMENT STATISTICS

UNITED STATES

	Producer Price Index[1] Industrial Commodities (1967=100)	Producer Price Index[1] All Commodities (1967=100)	Consumer Price Index[2] (1967=100)	GNP Implicit Price Deflator[3] (1972=100)	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4] Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1972 Avg.	117.9	119.1	125.3	100.00	4.56	4.59	4.26	3.71
1973 Avg.	125.9	134.7	133.1	105.75	4.84	4.98	4.51	3.91
1974 Avg.	153.8	160.1	147.7	115.08	5.44	5.63	4.88	4.21
1975 Avg.	171.5	174.9	161.2	125.79	6.13	6.24	5.39	4.64
1976 Avg.	182.4	183.0	170.5	132.34	6.76	6.87	5.91	4.96
1977 Avg.	195.1	194.2	181.5	140.05	7.28	7.67	6.43	5.39
1978 Avg.[5]	209.4	209.3	195.4	150.42	8.23	8.56	7.02	5.82
1979 Avg.	236.5	235.6	217.4	163.42	9.27	9.50	7.60	6.32
1980 Avg.	274.8	268.8	246.8	178.64	10.26	10.63	8.30	6.94
1981 Avg.	304.1	293.4	272.4	195.51	11.55	11.98	9.12	7.62
1982 Avg.[6]	312.3	299.3	289.1	207.15	12.33	12.94	9.96	8.21
1983 Avg.	315.8P	303.1P	298.4P	215.59P	—	—	10.58P	8.66P
Nov 1982	315.0	300.3	293.6	—	12.53	13.22	10.26	8.45
Dec 1982	315.2	300.7	292.4	210.00	12.53	13.05	10.32	8.51
Jan 1983	313.9	299.9	293.1	—	12.63	13.33	10.34	8.53
Feb 1983	313.9	300.9	293.2	—	12.66	13.29	10.41	8.56
Mar 1983	313.5	300.6	293.4	212.83	12.48	13.35	10.39	8.60
Apr 1983	312.4	300.6	295.5	—	12.67	13.34	10.43	8.60
May 1983	313.6	301.5	297.1	—	12.55	13.62	10.50	8.60
Jun 1983	315.3	302.4	298.1	214.55	12.66	13.38	10.52	8.63
Jul 1983	316.5	303.2	299.3	—	12.68	13.56	10.58	8.69
Aug 1983	317.3R	304.7R	300.3	—	12.63	13.46	10.61	8.64
Sep 1983	317.2	305.3	301.8	216.44	12.71	13.47	10.69	8.75
Oct 1983	318.7	306.3	302.6	—	12.78R	13.56	10.78	8.73
Nov 1983	318.3	305.6	303.1	—	12.78P	13.49P	10.85	8.77
Dec 1983	318.4P	306.0P	303.5P	218.53P	—	—	10.83P	8.85P

P = Preliminary R = Revised since last month

[1]US Bureau of Labor Statistics, Washington, D.C.: "Producer Prices and Price Indexes," (formerly "Wholesale Prices and Price Indexes"). Producer Price Indexes are revised four months after they are first released to reflect the availability of late reports and corrections by respondents.
[2]US Bureau of Labor Statistics, Washington, D.C.: Consumer Price Index for All Urban Consumers, US City Average, All Items.
[3]US Department of Commerce, Washington, D.C.: Bureau of Economic Analysis, National Income and Wealth Division: "Survey of Current Business." The GNP Implicit Price Deflator is published quarterly, and seasonally adjusted.
[4]US Bureau of Labor Statistics, Washington, D.C.: "Employment and Earnings." 2. All data based on 1972 revision of SIC Manual. Data for 1970-1976 are adjusted to the March 1977 benchmark. Data for 1977-1978 are adjusted to the March 1979 benchmark. Data for January 1979 and beyond are adjusted to the March 1980 benchmark.
[5]Monthly data 1970-1978 for Producer Price Index-Industrial Commodities, Consumer Price Index, and Employment and Earnings SIC codes 10, 333, and 28, and quarterly data for GNP Implicit Price Deflator appear on pages 4.6-4.8 of Report 139.
Monthly data 1977-1978 for Employment and Earnings SIC Codes 10, 333, and 28 appear on page 33 of Report 147.
Monthly data 1970-1978 for Employment and Earnings SIC Code 36 appear on page 23 of Report 154.
Monthly data 1977-1980 for Producer Price Index-All Commodities, appear on page 21 of Nuexco Report 158.
[6]Monthly data 1979-1982 for all listed indices appear on page 41 of Report 184.

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REPRESENTATIVES AND CONSULTANTS

AUSTRALIA

Peter Stork
Oratom Consulting*
5 Gould Ave.
St. Ives
NSW 2075, Australia
Telephone: (61-2) 449-6783
Telex: 23976 (COMTLX)

JAPAN

Kazy Yokota
Japan Tech Services*
Ohkura Building (3F)
1-4-10 Shiba Daimon
Minato-ku, Tokyo, Japan
Telephone: (81-3) 431-6031, 6025
Telex: 242-5060 (JATECH J)

SOUTH AFRICA

Chris I. Von Christierson
Southern Prospecting (Pty) Limited*
P.O. Box 61409
Marshalltown 2107
Republic of South Africa
Telephone: (27-11) 838-1868
Telex: 8-9878 SA

TAIWAN

Edward Bee
Bee & Liang Company, Ltd.*
14 Fl. Universal Business Center
NO. 663, Tun Hwa South Road
P.O. Box 1396
Taipei, Taiwan R.O.C.
Telephone: (886-2) 704-9630
IWX: 785-11570 (BEELIANG)

UNITED STATES

Harold C. Lindberg*
83-A Hardee Lane
Whispering Pines, N.C. 28327
Telephone: (919) 949-3622

Joe L. Hixon*
302 Lombardy
Sugarland, Texas 77478
Telephone: (713) 494-3802

W. Hardy Prentice*
11644 Harborview Drive
Cleveland, Ohio 44102
Telephone: (216) 631-2350

SPECIAL CONSULTANTS

Karl Cohen
Palo Alto, California

James C.C. Stewart
England

Claus C. Thiesen
Kirkland, Washington

W. Bryan Webster
San Jose, California

T.C. Wu
Hong Kong

*Independent contractors representing Nuexco

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